

MODERN Machine Shop

REG. U. S. PAT. OFF.

A Magazine for Machine Shop Executives

HOWARD CAMPBELL, Editor

Vol. 2

MAY, 1930

No. 12

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MODERN Machine Shop

CINCINNATI, OHIO

MAY, 1930

VOL. 2, No. 12

Power Speed Reducers Aid Locomotive Repairs

By H. H. HENSON

A SMALL amount of power, properly applied, can be made to perform a huge task. This fact has been known for thousands of years, as evidenced by the statement of one of the ancient Greeks that if he had a lever long enough, he could move the earth. Leverage is all that is necessary, and leverage can be applied in many forms, but modern industrial efficiency demands that it be applied intelligently.

The most common of the modern forms of applying leverage is through the use of the power speed reducer,

by means of which a small high speed power unit can be made to do tasks that would otherwise require a large, low speed unit. The small high speed power unit is more efficient, just as powerful when coupled with the proper equipment, and less costly than the large unit. The majority of the power units referred to are in the form of electric motors, but the term may apply to air motors or other kinds of units as well.

Power speed reducers can be made to perform valuable service in locomotive repair shops, and the use of

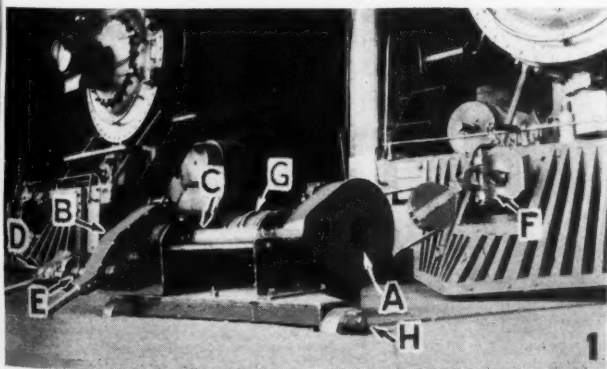


Fig. 1—The air motor, driving a speed reducer attached to a winch, pulls the locomotive.

such units for locomotive work is increasing. Speed reducers can be used with either air or electric motors to move locomotives back and forth over the pits, raise them so that tires can be changed, drive boring bars for boring valve chambers, pull cylinder bushings and valve chamber bushings out and in, and so on. An example of the manner in which a speed reducer can be applied to a winch so that a portable air motor can be used to pull a locomotive is shown in Fig. 1.

In this illustration the air motor **D** is driving a pinion in the speed reducer **B**, the pinion driving a set of compound gearing through which power is transmitted to the drive shaft **C** of a spur-gear winch. The gears of the winch have a ratio of

3 to 1, the large gear (indicated at **A**) being attached to the end of the rope drum **G**. The drum is 7 in. diameter and 40 in. long, and the surface of the entire length of the drum is serrated to take a $\frac{5}{8}$ -in. wire cable. The serrations are cut $\frac{3}{8}$ -in. deep on a $\frac{3}{4}$ -in. pitch, to keep the cable from interwinding on the drum.

The gears in the speed reducer **B** are 6 P., 12 to 1 ratio, and are encased in an oil-tight steel housing. The gears run in oil or light grease which is pumped in with a grease gun. All gear shafts run in bronze bearings. The shaft of the driving pinion is made with a Morse No. 5 taper shank and protrudes from the housing so that it can be inserted into the sleeve of the air motor, indicated at **E**. The complete outfit is

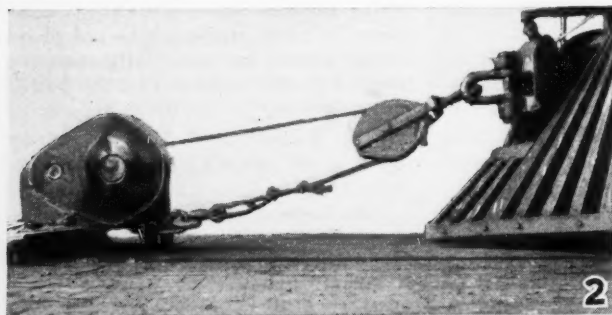
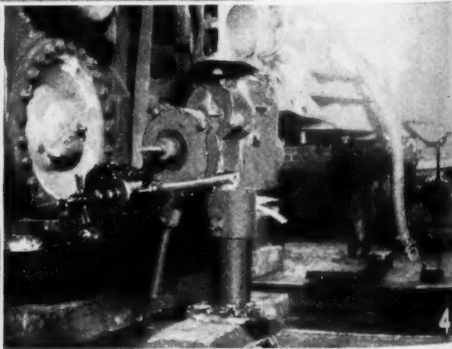
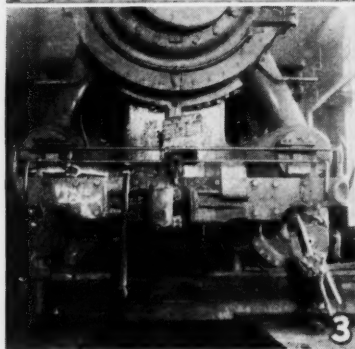


Fig. 2—Side view of winch, showing method of attaching to locomotive. Fig. 3—Using an air motor to raise a locomotive. Fig. 4—Close-up view showing method of attaching air motor to power jack.



supported on a frame of heavy steel plate, anchored to the stop-blocks **H** by a 2-in. rod which passes through

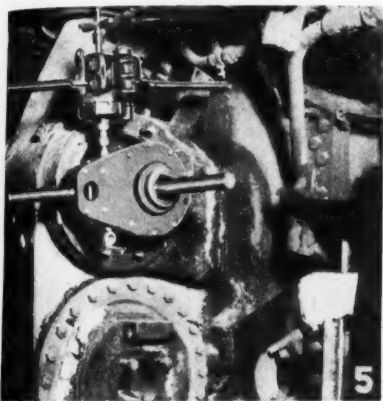


Fig. 5—Using an air motor and gear reduction unit to pull a valve bushing into place.

both blocks. The wire cable is passed around the sheave of a pulley and the end is then anchored to the frame.

In order to provide means for attaching the cable to the locomotive, a clevis jaw **F** is pinned to the front draw head. A side view of the equipment with the pulley hooked to the locomotive is shown in Fig. 2. The pulley is necessary only when moving the heavier types of engines; the smaller ones can be pulled from the winch direct. By hooking the cable to the end of another cable that has been attached to the rear of the locomotive and passed around another block-sheave, the locomotive can be

pulled backward as well as forward.

An 180-ton locomotive can be raised 12 inches in three minutes by the use of speed reducers applied to jacks as shown in Figs. 3 and 4. These reducers are of a smaller size, using 8 P. spur gears, 5 to 1 ratio. In Fig. 5 is shown one of the smaller units set up to pull a valve chamber bushing into place, eliminating the necessity for using the usual wrench and screw and saving both time and hard labor. The equipment used as shown in the illustration consists of an air motor, a draw bolt, two end plates, a ball thrust bearing, and a bronze nut, assembled as shown in Fig. 6. The draw bolt is indicated at **A**, the end plates at **B**, and the thrust bearing **C**. A 3-in. diameter bolt is used to pull in the cylinder bushings, the bolt being $3\frac{1}{2}$ in. in diameter. The length of the bolt is governed by conditions. A standard thread, to take a 3-in. or $3\frac{1}{2}$ -in. nut, is cut on one end, and 36 inches of square thread, to correspond with the thread in the barrel of the worm gear in the speed reducer, is cut on the other end.

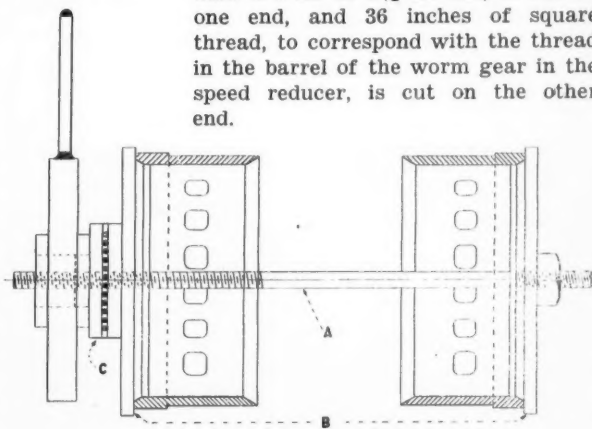
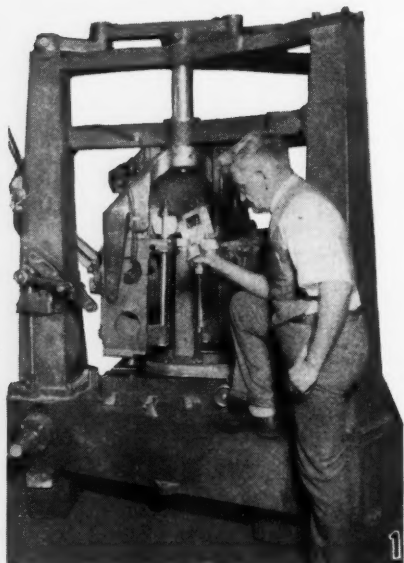


Fig. 6—Details of bushing-puller.

The operating mechanism of the reduction unit consists primarily of a steel worm 7 in. long by 3 in. dia-

(Continued on page 48)



THE above slogan expresses perfectly the idea upon which the success of the Miami Tool & Die Co., of Dayton, Ohio, is founded. This shop has grown in fifteen years from a one-man shop to a plant which covers approximately 60,000 square

"Let The Machine Do It"

By EDMUND LEDUC

feet of floor space and employs some one hundred men. The president, W. F. Miller, is a practical tool and die maker, as well as a designer and engineer of recognized ability. Associated with him are Wm. E. John, general manager, and E. E. Rhodes, designing engineer.

These men adhere strongly to the belief that anything that can be done by hand can be done—and better—by mechanical means, and this idea has brought the shop a great many opportunities to develop and build

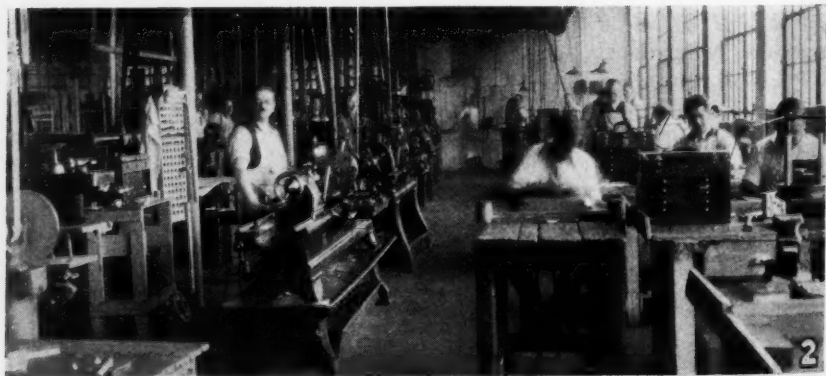


Fig. 2—Jig and fixture work is handled on this side of the shop. The grinding department is at the rear.



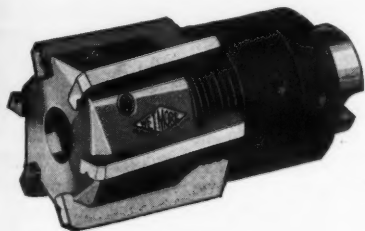
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This reamer is also adaptable for bars or arbors where one or more reamers are used at same time. Sizes range from 1 1/4" diameter to 6"; six, eight, ten, or twelve blades, depending on size. Left-hand angle blades prevent "digging in," chattering, and scoring while backing out.

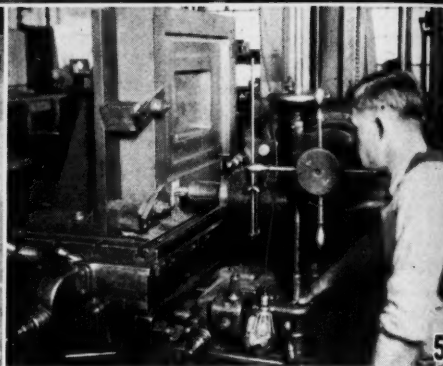
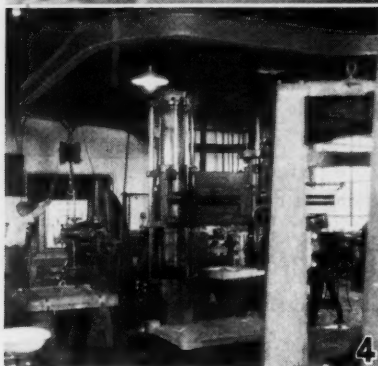


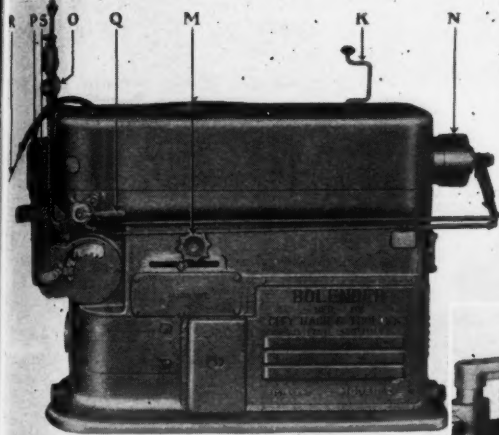
Fig. 3—Heavy die work is handled in this department. Fig. 4—A monorail trolley system serves the larger machines and extends to the benches. Fig. 5—Machining a "Frigidaire" panel die on a G & L Horizontal Boring Machine.

special machines. The illustration at the head of this article shows one of the designers examining the product of a machine which he designed to perform the somewhat intricate operation of forming the heel for a woman's shoe. The task involved in the development of this machine may be considered as a fair example of the type of problems that are put up to this organization for solution.

The shop is well-equipped for fine tool, die and special machine work. The equipment includes forty benches,

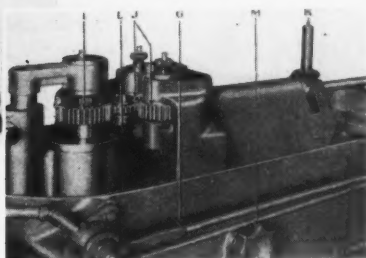
arranged along the two sides of the plant as shown in Figs. 2 and 3, with the batteries of lathes, milling machines, drill presses, and other machines occupying the center of the shop. An overhead monorail, carrying several three-ton chain blocks, is located so that it serves both the heavier of the machine tools and the benches, thus making it possible to transfer heavy work to practically any part of the shop without difficulty. Figure 4 shows a mechanic in the act of lowering a large die shoe

ANNOUNCING The New BOLENDER Model No. 2 GEAR BURNISHER



Burnisher "I" is driven by power. Burnishers "J" are loosely mounted on spindles carried by a slide adjusted by "K." Gear to be burnished is carried on mandrel integral with screw "L," adjusted by turning knob "M." Pressure to burnishing rolls supplied by air through cylinder "N," controlled by air valve "Q."

To start burnishing cycle depress switch handle "P," reverse mechanism automatically controlled. Nozzle for cleaning purposes marked "R," oil reservoir "S."



MODERN machine design demands perfect, smooth-running gears. The New Model No. 2 **BOLENDER GEAR BURNISHER** provides the ideal means of perfecting the bearing surface of each gear from 1½" to 14" O. D. x 2½" face as it comes from the gear cutting machine.

One outstanding feature of this machine is a successful completely automatic burnishing cycle. Another is that the gear lies in a horizontal position with the center line vertical. This

eliminates all overhang or unevenness in pressure due to uneven weight distribution.

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DAYTON, OHIO, U.S.A.

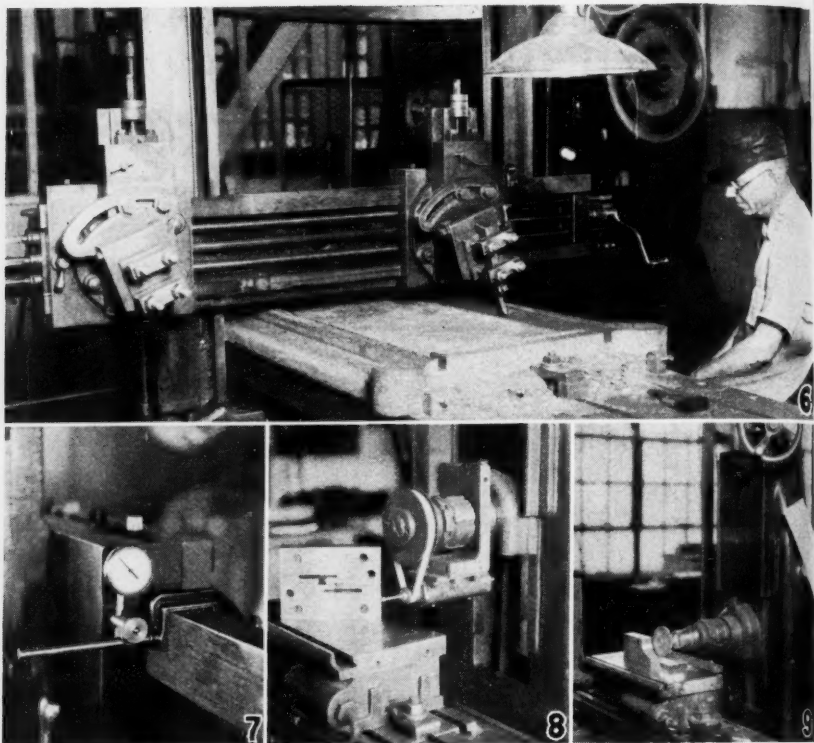


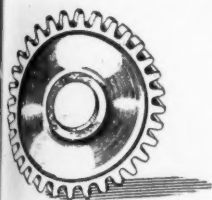
Fig. 6—Planing the shoe for the "Frigidaire" panel die. Fig. 7—A dial indicator clamped to the planer rail aids in setting the tool. Fig. 8—An internal attachment, operated from a wood pulley on the machine spindle, converts this surface grinder into an internal grinder. Fig. 9—All radii are ground, saving time and producing better work.

onto the table of a Giddings & Lewis horizontal boring machine. This die, which is a drawing die for one of the panels for the "Frigidaire," is shown in process of machining in Fig. 5.

The operation shown in Fig. 6 is that of planing a die shoe for a "Frigidaire" panel. As the operator is working to a limit of .001 inch on a dimension of 28.500 inches, he has eliminated the necessity for "cutting and trying" in order to obtain an accurate tool setting by the use of a dial indicator which he has clamped to the rail of the machine as

shown in the illustration, Fig. 7.

The grinding equipment, which is grouped to form a department, includes four B. & S. surface grinders, two large B. & S. cylindrical grinders, and two Herald internal grinders. Figure 8 shows a surface grinding machine to which an internal grinding attachment has been applied, the external grinding wheel having been removed to allow for the substitution of a wood pulley. The grinding wheel, which is $\frac{1}{8}$ -in. in diameter, is used to finish the slots in a die that is being made for the Western Electric



One Gear Shaper versus 6 Other Machines

THIS cast brass meter gear, which has 32 teeth, 32 pitch, $14\frac{1}{2}^\circ$ pressure angle, $\frac{3}{16}$ inch face, was formerly cut on special bench type machines.

It required six of these special machines and six operators to produce 4500 gears in eight hours. One High-Speed Gear Shaper and one operator produced 5600 gears in eight hours, or 1100 more than were produced by six machines and six operators.

The cutting of these gears also demonstrated the economy of the Gear Shaper cutter. Formerly small milling cutters were used, which cost \$0.80 each. These cutters produced 80 gears between "grinds"; and a total of 800 to 1000 gears before the cutter had to be discarded.

The Gear Shaper cutter produced 6800 gears instead of 80 between "grinds", and approximately one million (1,000,000) gears before it was used up. Reduced to plain figures, including cost of sharpening cutters:

Milling cutter costs were \$3.90 per 1000 gears. The Gear Shaper cutter reduced it to \$0.10 per 1000 gears—a saving of \$3.80 per 1000 gears, or more than 97% of former costs.

Booklet No. 12 presents many other interesting facts—want a copy?

THE FELLOWS GEAR SHAPER CO.

Head Office and Works: 78 River St., SPRINGFIELD, VT., U.S.A.

Branch Office: 1149 Book Bldg., DETROIT, MICH.



Fig. 10—Hand-filing has been largely eliminated by the use of this Rausch Rotary Filer. Fig. 11—Using a Dumore Grinder and emery pencil to smooth up the irregular surface of a small die. Fig. 12—Using the center finder to locate the center of a hole on the Pratt & Whitney jig-boring machine.

Company, of Chicago, Illinois.

The machine shown in Fig. 9 is being used to grind a radius in a die-section. The forming of radii, which is usually done by boring or by other means which involve more or less complicated clamping and tool setting, is accomplished here by the use of grinding wheels as shown. By keeping on hand a number of wheels of graduated sizes, any size radius desired can be obtained with but little dressing of the wheel and it is only necessary to add a full size wheel to the set when the smallest has to be discarded. The job can be set up quicker and a better job can be obtained by grinding the radii than by any other means.

An idea of the extent to which machines have replaced hand work in this shop can be gathered by reference to Fig. 10. The mechanic shown



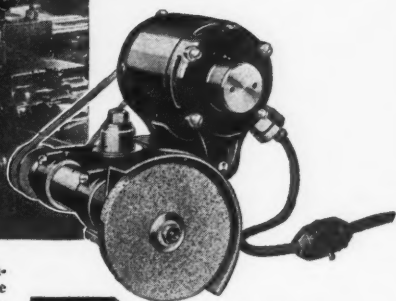
here is using a Rausch rotary filer, with a round file, to finish an irregular part of the surface of a section of a blanking die. The machine holds the file square with the sides of the die and operates the file at a much faster speed than is possible by hand, in addition to which it leaves the operator the use of both hands with which to locate and guide the work.

Another fine piece of labor-saving equipment is the Dumore flexible shaft grinder shown in use in Fig. 11. Irregular-shaped surfaces, such as the surface of the tray-handle die shown in process, can be finished much quicker, easier, and better with

7 DUMORE No. 3's show MARKED EFFICIENCY on difficult grinding job



..... Jacobs Mfg. Co.
increases production,
decreases maintenance
—does better work
with battery of Dumore
Grinders!



The Dumore Grinder No. 5 has a full 1/2 H. P. Dumore Motor of the Universal type . . . automatic oiling system . . . fan which keeps the motor "cool" at all speeds . . . aluminum housing for light weight . . . variable speed . . . four quills . . . five pulleys . . . automatic belt tensions . . . precision to .0001" . . . spindle speeds of 3,600 to 35,000 R.P.M.

OPERATING at 40,000 R. P. M.; doing a precision internal grinding job on chuck jaws which range in size from 1/8" to 1"; in continuous operation 55 hours a week; 200 to 250 hours without adjustment! This is the record which a battery of seven Dumore No. 3 Grinders have made in the plant of the Jacobs Mfg. Co., Hartford, Conn.

The experience of the Jacobs Mfg. Company with the No. 3 grinders proved so satisfactory that it was recently decided to further step up production by gradually replacing them with the new and more powerful No. 5 Grinders. The No. 5's installed to date already show an increase in production of 15%.

In every respect Dumore Grinders have lived up to expectations in the Jacobs plant. On one operation, particularly, which imposes a terrific test on the grinder, the sturdy construction, solid spindle shaft, self-oiling features, air-cooled and variable speeds make it exceptionally efficient.

THE DUMORE COMPANY
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FRACTIONAL HORSE POWER **MOTORS**

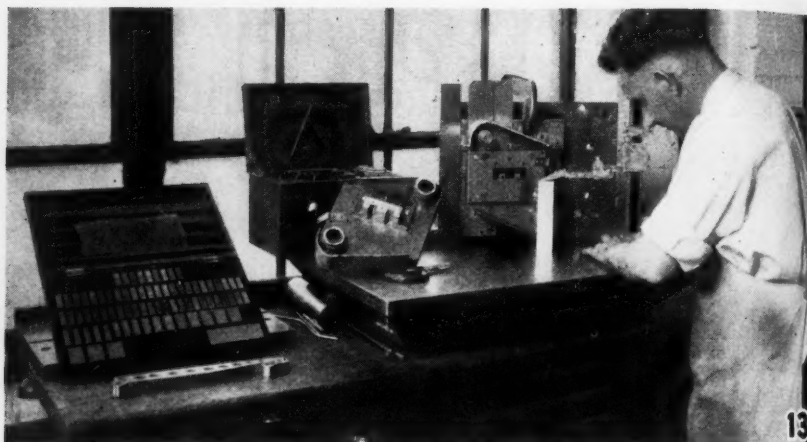


Fig. 13—A part of the inspection equipment.

a tool of this kind than by the hand method. Using a tapered wheel or "emery pencil" of small diameter, operating at a speed of 40,000 r.p.m., an otherwise laborious task is accomplished in a comparatively short time.

Probably the finest piece of equipment in the shop is the Pratt & Whitney jig-boring machine shown in Fig. 12. The operator is using a "Schwieterman" center finder to locate the center of a hole while the spindle is running, this tool making it possible to locate the center in a minimum of time. The spindle of the tool rotates with the spindle of the machine while the test indicator is held stationary, and a center can be located by this means, within .0002 inch, in less than a minute. The dial indicators that are built into the machine, together with the end-measures and micrometers that are furnished with the machine, provide a positive method of locating and boring holes to an extreme accuracy in a minimum of time.

Each tool, die, jig or special machine is given a thorough final in-

spection before it is released to the customer, and upon the inspector falls the responsibility for any future complaints. His task is simplified, as far as possible, by the use of precision gages of the most modern types. A part of the inspection equipment is shown in Fig. 13.

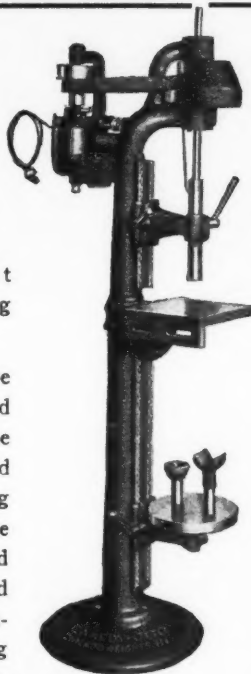
One of the outstanding reasons for the success of this company is its strict adherence to delivery dates. When a promise of shipment has been given to a customer, this date automatically becomes a law to everyone concerned, and a percentage of the work done on each tool is checked daily and compared to the date promised. If this percentage does not compare favorably with the promised delivery date, immediate steps are taken to maintain the proper proportion in order to assure everyone concerned that the tool in question will be forwarded to the customer as promised. It is equally important that the tool pass a rigid inspection before being shipped to the customer, as the members of this

(Continued on page 38)

THIS FLOOR DRILL COMES TO YOU READY FOR THE JOB

That is the first cost-reducing feature of the Canedy-Otto 14" Sliding Head Sensitive Floor Drill. It comes to you complete—ready for your work by attaching to any convenient light socket. There is nothing extra to buy.

Another convenient feature is the two tables furnished as regular equipment. The square table may be tilted to any angle or swung around the column. The round table can be moved to any desired height and securely clamped by a conveniently located locking lever, or it may be replaced by the cupped cen-



"Another C-O precision built drilling unit."

ter or "V" block, as desired.

This drill—a fast production machine for holes from 0 to $\frac{1}{2}$ "—can be furnished either as a single spindle machine, or with multiple spindles in the floor or bench type. The cone pulley runs in Timken Roller Bearings and the spindle runs in thrust bearings, supported by a sleeve with an extra long bearing.

The spindle speeds are 400, 850, 1,750 r.p.m.; 525, 1,400, 3,000 r.p.m.; 1,000, 2,200, 5,000 r.p.m.; and 3,400, 5,600, 10,000 r.p.m.

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Modern Tooling Practice, II

By FRANK W. CURTIS

WHEN a designer is able to determine the best method of finishing any part in a given mechanism, and when he is at the same time able to lay out and design the necessary tools, he may be classed as a tool engineer. This field offers excellent opportunities for the progressive mechanical engineer, and the

in., and 36 by any desired length. In making tool drawings, a standard method of cross-sectioning should be used so that the task of deciphering the drawings will be simplified as far as possible. The section marks most commonly used are reproduced in Fig. 6.

Many individual manufacturers have standardized certain units used in connection with tool construction in their plants. Any contribution that can be made in this direction will tend to substantially reduce tool cost. Standardization will stimulate the use of tools for parts that were previously made without tools. In Fig. 7

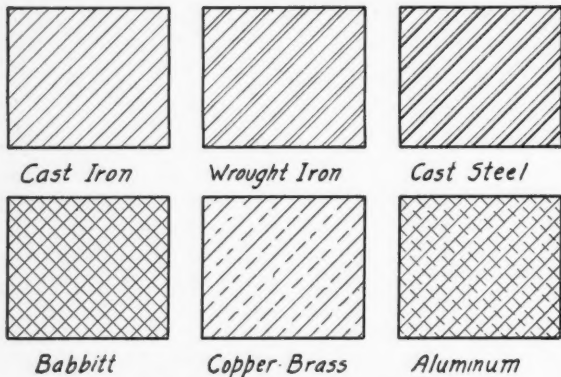


Fig. 6—Standard Cross-Sections

results obtained by careful study of the subject are unusually gratifying because they are of such great importance in helping to reduce the cost of manufacturing. And costs are of prime interest to any manufacturer.

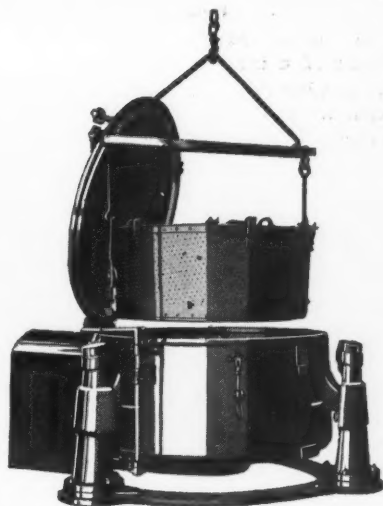
Certain methods of procedure in connection with tool drawings and tool-designing practice have been so universally adopted as to have become practically standard practice, including the organization of the tool drafting room from an economic standpoint. Tool drawings are usually made in standard sizes, such as 9 x 12 in., 12 x 18 in., 18 x 24 in., 24 x 36

shown a representative group of parts that can be standardized to suit individual requirements. Those shown represent bushings, screws, knobs, and handles. Other parts such as washers, angle plates, legs or feet, taps and threads, bolts, and dowel pins, can also be standardized. Such designs should be recorded in the form of a loose leaf data-sheet book and kept available for reference purposes. It would also be found advisable to include sheets tabulating the sizes of steel flats, rounds, and so on, which are carried in stock, with lists of gauges, sizes, drill sizes, and other tab-

FOR THE CHEAPEST CUTTING OIL

THE cheapest cutting oil in the world is the oil you recover from your own oily chips with a Tolhurst Chip Wringer.

The Tolhurst Chip Wringer has a great capacity—you require fewer units, less labor. It handles the longest, curliest turnings as well as the finest chips. It is a modern, high-



efficiency machine; it operates with extremely low power and maintenance.

Let us give you complete information on the cost, installation and operation of Tolhurst Chip Wringers for your plant. Use the coupon.

TOLHURST Chip Wringers

TOLHURST MACHINE WORKS, Inc.,
646 N. Fulton Street, Troy, N. Y.

Gentlemen: Please give me the facts on Tolhurst Chip Wringers. We handle about pounds of chips a day. The material is..... We prefer (line shaft) (individual) drive.

NAME

COMPANY..... ADDRESS.....

Units for Jigs and Fixtures

A jig or fixture is usually composed of a main body, or frame, and a number of supplementary units, such as bushings, bushing plates, clamps, locating blocks, and plungers.

ance with the type of work to be machined, the machine to be used, and the amount of production required.

There are many advantages to be obtained from the use of standard drill-jig bushings. To some extent,

drill and reamer bushings should be standard just the same as drills and reamers. In some cases a special type of bushing is required, but in the majority of jigs it will be found quite possible to adopt some form of standard design both to facilitate interchangeability, and so that bushings will be available for replacement without delay.

Bushings receive a great amount of wear, therefore they should be made of the finest grade of tool steel, properly hardened and ground. When close tolerances are required, it may be necessary to replace bushings often, depending, of course, upon the service required of them. For

this reason it will be found advantageous to standardize the general proportions of bushings, and design the jig leaf or body around these proportions. Adhering to this practice will make it possible to carry a surplus stock of finished bushings, or bushings partly finished, so that there will be no time lost when it becomes necessary to replace a worn or broken bushing.

A great many types of bushings are used in connection with drill-jig design, but generally speaking, there

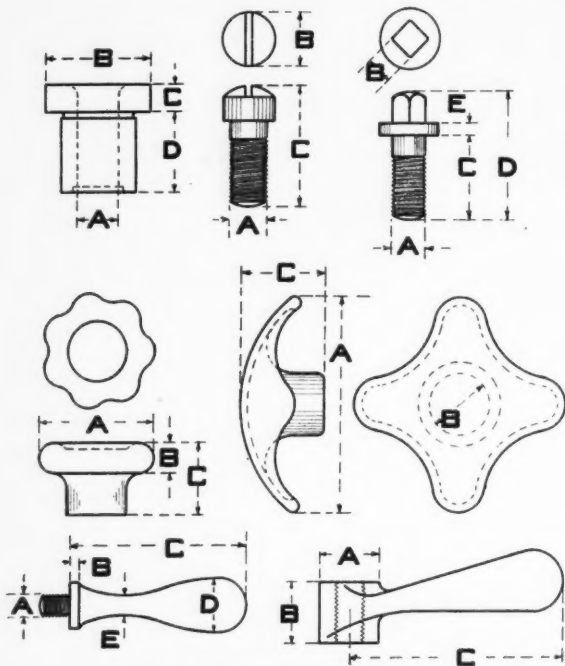


Fig. 7—Standardized Jig Parts.

The design of these supplementary units is as essential as the design of the body itself, because much depends upon these units in making the jig or fixture practical and economical. For example, it is quite necessary that an adequate and rapid clamping method be provided in any form of tool in which a workpiece is to be held, and naturally the results will not be gratifying if a weak clamping unit is employed. For this reason, great care should be taken to apply proper supplementary units in accord-

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are only four that come within the scope of standardization. These four are illustrated in Fig. 8. The bushing shown at A is known as the plain stationary type, and is usually made

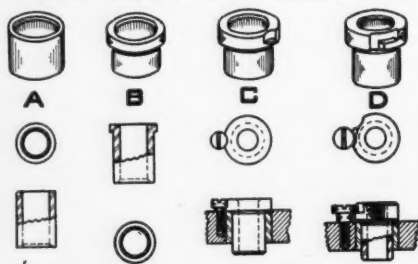


Fig. 8—Standardized Jig Bushings

for a press fit in the jig body. This type of bushing is also used as a liner for replaceable and slip bushings. The design shown at B is also a press-fit type of bushing, although it has a shoulder so that it can be pressed into the body against a boss or flat surface. A replaceable type of bushing is shown at C. A bushing of this design is usually stationary, and is held in place by a screw. It sometimes is used in combination with the plain bushing, and is used in jigs where severe work is required. The main feature of this type of bushing lies in that it can be replaced rapidly with little loss of time. The screw not only holds the bushing in place, but prevents it from turning. The bushing shown at D is known as the slip type, and is removable. This type of bushing is used in connection with jigs in which the work is drilled and reamed at one setting, both drilling and reaming being done with bushings of the proper size. The bushing is held in place by means of a fillister head screw, which fits into a bayonet-type lock machined in the head of the bushing.

Bushing Proportions

Sometimes the drill jig is of such

a nature that the wall or section into which a bushing is to be placed is thin, making it necessary to provide a bushing of special size. If the bushing is made as shown at A in Fig. 9, there is a likelihood of the drill running out of center, inasmuch as the height of the bushing is not sufficient to provide a satisfactory bearing. For the average bushing, the height H should be at least $2\frac{1}{2}$ times the diameter D. This rule cannot be adhered to in all cases, but is a safe one to follow. In drilling small holes, the bushing hole is often five or six times higher than the diameter, which, of course, is not objectionable. The clearance between the bushing and the workpiece is important and should be provided according to distinct rules. The first is to have the bushing against the work, as shown at B, and

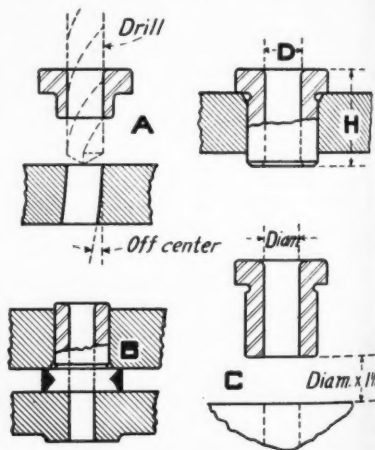
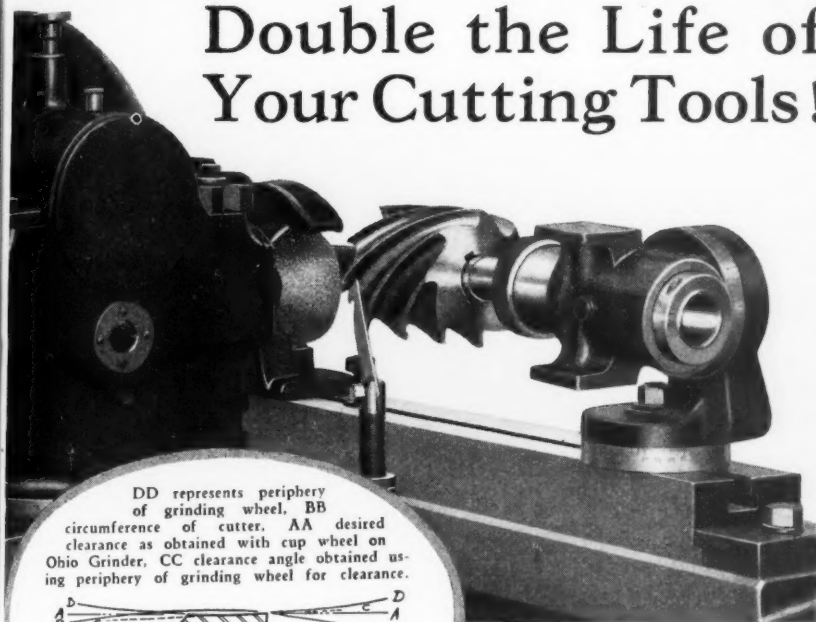


Fig. 9—Proportions of Jig Bushings

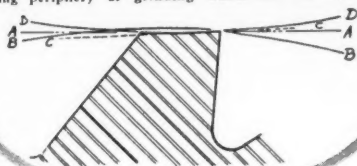
the other is to have the gap approximately one and one-half times the diameter of the drill, as shown at C. As in the proportions of the bushing, this rule can be altered slightly, but there must be sufficient clearance for

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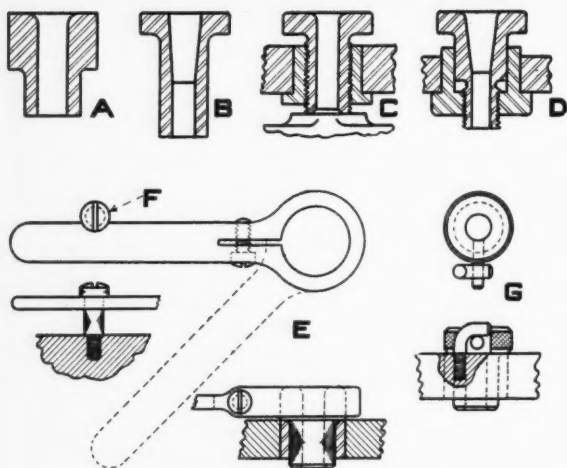


Fig. 10—Special Bushing Designs

chips. If the gap is made too small, chips will be apt to clog up in such a way that excessive heat will be generated during drilling. If the bushing lies directly against the work, the chips will have a free passage through the bushing.

When the proportions of a jig will not permit a standard form of bushing, a design such as shown at A in Fig. 10 will be found satisfactory. In this case, the head of the bushing is much higher than in the usual design. Taking the other extreme, where a long bushing is required, it will be permissible to relieve the upper proportion with a taper, such as shown at B. It is quite possible to have too large a bearing as well as too small a bearing, and this rule must be watched carefully.

At C is shown a screw-type bushing that is used for holding the work-piece in place as well as for alignment of the drill. Sometimes the heads of screw-type bushings are provided with pins to serve as handles

for obtaining the proper clamping pressure. At D is shown another form of screw-type bushing, used where extreme accuracy is required. The bushing receives a bearing, and does not depend upon the threads for alignment.

Slip-type bushings are held in place by various means, the handle shown at E being one of the devices used for this purpose. The handle has a pinch binder that permits the clamping end to

be securely fastened around the head of the bushing. The screw F is used to avoid rotation and to prevent the bushing from pulling out when the drill is raised. Another form of lock for slip-type bushings is shown at G. In this case the head of the bushing

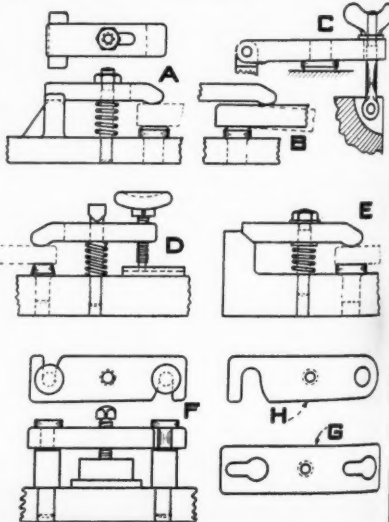
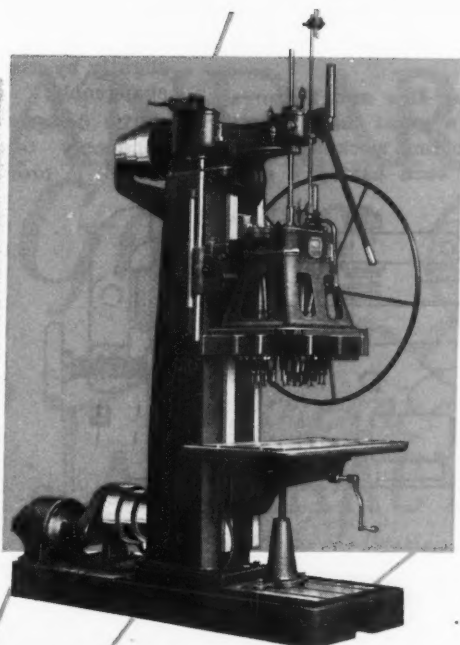


Fig. 11—Common Types of Clamps.



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is provided with a pin that fits over a hook-bolt fastened in the body of the jig.

Clamps for Jigs and Fixtures

There are a great many forms of clamps for holding workpieces in jigs and fixtures, each having a distinct

offer a variety of miscellaneous uses. These designs can be altered slightly by using their features interchangeably.

The design shown at A, Fig. 12, commonly termed the strap-type

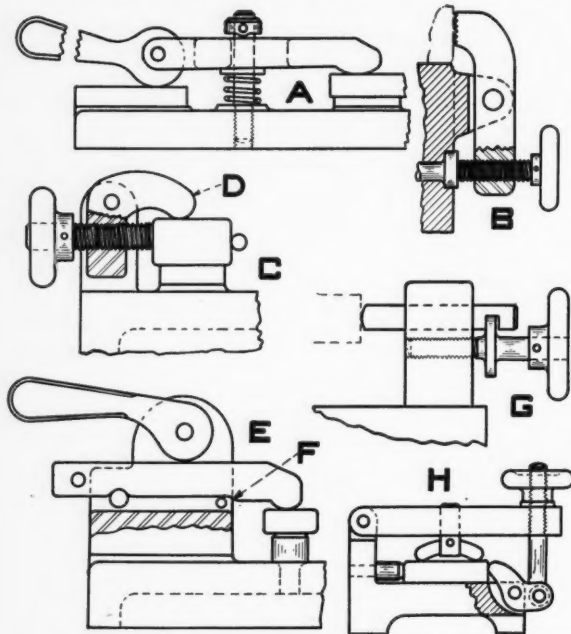


Fig. 12—Types of Cam-Lever and Multiple Clamps

field. Rapid semi-automatic type clamps are used when high production is required, whereas the simple type is used when time is not such an important factor. It is hard to give any definite rule regarding the use of clamps, because the nature of the work as well as the operation to be performed determines the type of clamp to be used. For this reason the designer must analyze the requirements carefully and then make a proper decision as to the style required. The clamps illustrated here

offer a variety of miscellaneous uses. These designs can be altered slightly by using their features interchangeably. The design shown at A, Fig. 12, commonly termed the strap-type clamp, is provided with a heel support at the rear end of a height equal to that of the workpiece. When the clamp is released, it can be drawn back out of the way to permit easy removal of the work. As shown the clamping is done directly over a locating point, which is quite essential to avoid springing of the workpiece. If the clamp were made as shown at B there is a possibility that the work would be sprung as shown by the dotted lines. The clamp shown at C operates slightly differently in that an eye bolt, hinged on the fixture body and locked with a wing nut, is used to operate the clamp. In this case the clamp is hinged so

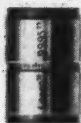
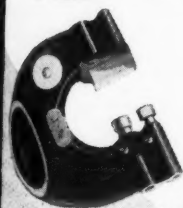
that it can be swung back out of the way to permit loading and unloading of the workpieces. The clamp shown at D has the fulcrum point at the center and can be thrown back away from the work for loading purposes.

The clamp indicated at E is of the swinging type, in that it can be turned around after the clamping pressure has been released to permit removal of the work. The heel of the clamp is angular and bears against a projection made integral with the jig or fixture body. A removable type

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of clamp is shown at F. In this case, the clamp has two C-slots, one at each end, which fit over the shoulder pins mounted on the fixture body.

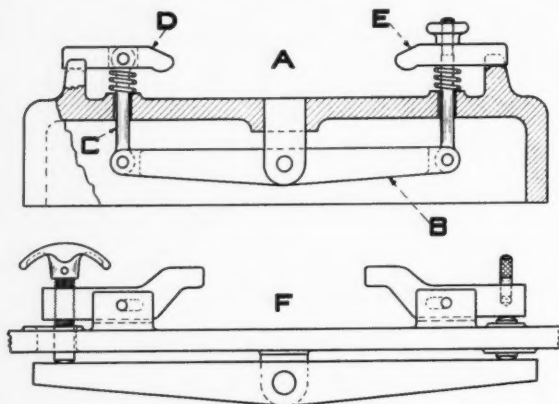


Fig. 13—Equalizing Clamps

When clamping pressure is released, the clamp can be turned slightly and removed entirely. The clamp G is also removable, although bayonet-type openings, instead of C-slots, are provided at each end. The clamp H has the C-slot at one end only, and can be swung around to permit loading.

Another variety of clamps is shown in Fig. 12. The clamp shown at A is of the cam type, a cam-handle serving to lock the clamp against the work. A clamp of this type is rapid in operation, and will be found satisfactory for a great many forms of jigs and fixtures. The lever type clamp B is very often used when an end clamping pressure is required. The clamp in this case works vertically instead of horizontally. A clamp of the double-acting type is shown at C. Here the clamping member D is pivoted in such a way that the work is held by clamping screw as well as by the clamp itself. Clamps of this type provide for a combination of both downward and end pressure.

Another form of cam clamp is shown at E. This clamp is of the built-up type and is rapid in operation. The body is made of a block

of steel slotted through the center to suit the width of the clamp. A pin is used as a fulcrum point. When the clamp is drawn back, the raised section F strikes a pin located at the front end of the block, which causes the clamp to raise off the work. In other words, when the clamp is being brought into position, it does not rub on the face of the work until it has reached the approximate clamp-

ing position, preventing marring.

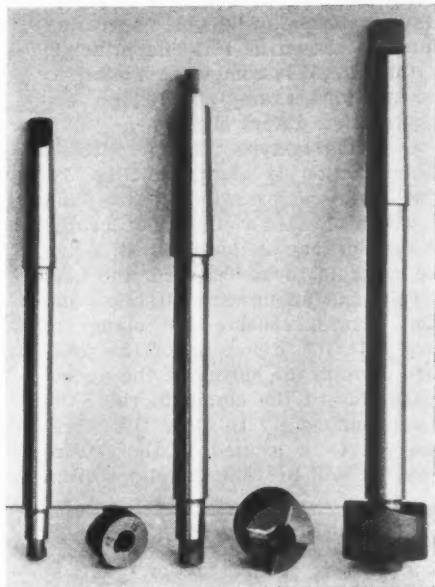
Sometimes it is necessary to provide a clamp that does not have any rotation, or torque, as it strikes the work, in which case the design shown at G will be found satisfactory. The screw is made with a shoulder that operates in a slot cut into the clamping pin. The action of the pin is directly in and out, so that there is no possibility of marring the workpiece, as is the case when a screw is used. At H is shown a clamp with a double action, operated by means of a hinged clamp that strikes the end of the work when the hand knob is tightened. At the same time a swinging-type clamp, located in the leaf, strikes the upper face of the workpiece.

Another form of double-type clamp, with one adjustment, is shown at A in Fig. 13. In this case, when the knob is screwed down on the handle, the hinged bar B is pulled upward at one end and down at the other, applying pressure to the eye bolt C and the clamp D, to which it is attached.

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At the same time, the hinged-type clamp **E** is brought into action. Another form of double operating clamp is shown at **F**. The principle of this clamp is somewhat similar to the previous example, although the construction differs slightly.

A swinging-type clamp with a double action is shown in Fig. 14. This clamp is operated by the cam **A**, which fits into a milled slot located on the top face of the clamp **B**. When the work is to be released, the cam is raised in an upward direction and then turned, causing the clamp to turn with it. Releasing of the pressure permits the spring at the underneath side of the clamp to raise the clamp sufficiently to clear the work. The pin **C** is located in the fixture where it will prevent the clamp from

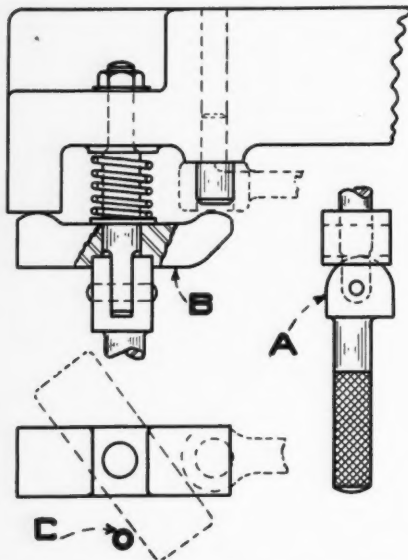


Fig. 14—Swinging-Type, Double-Action Clamp turning too far when it is swung away from the clamping position.

A combination clamp and spring plunger, operated with a single ac-

tion, is shown in Fig. 15. In this case the clamping pressure is obtained by the cam handle **A**, which

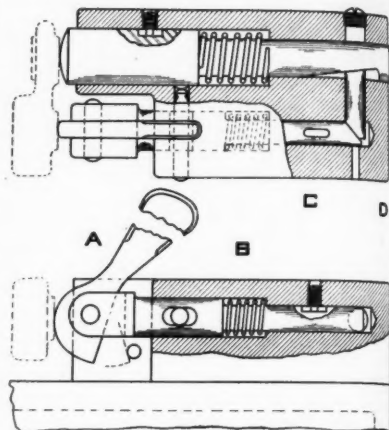


Fig. 15—Combination Clamp and Spring Plunger

strikes the face of the workpiece. This action causes the clamp to push back slightly and carry the yoke pin **B** with it. The end of this pin, through an angular face, causes a transfer of the pressure to the spring plunger, locking pin **C**. This design can be altered slightly to suit prevailing conditions and will be found convenient and rapid for a variety of clamping arrangements.

"Let the Machine Do It"

(Continued from page 22)

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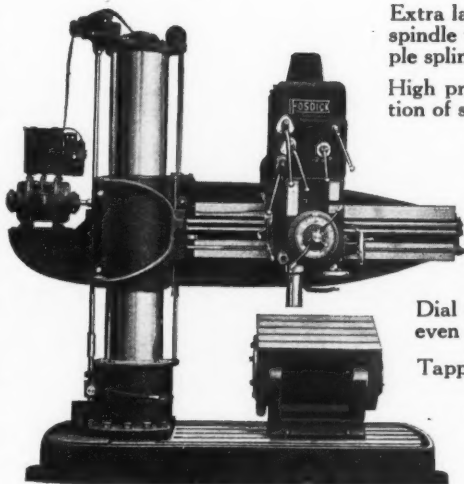
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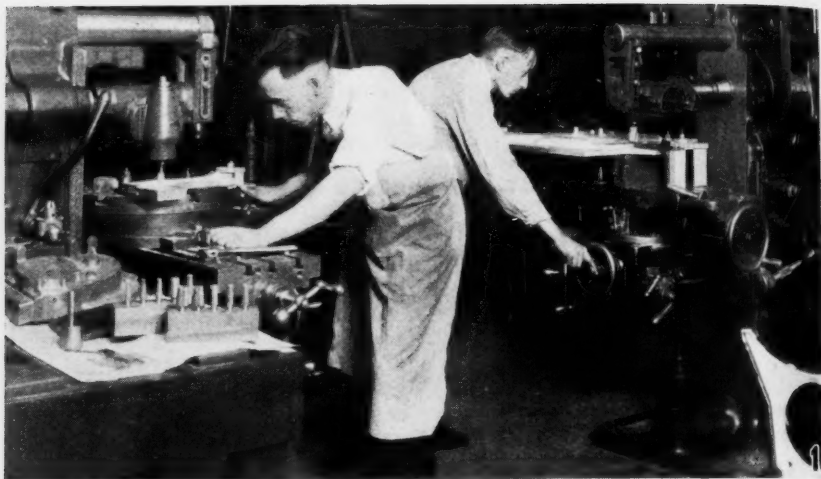


Fig. 1—Using horizontal milling machines, equipped with milling attachments, for profiling irregular surfaces on metal patterns.

An Accessory Unit That Simplifies Difficult Operations

By DONALD A. CLARK

MANY of the mechanical units that have been built in the past have fallen short of perfection, due, not to lack of ability on the part of the designer, but rather to lack of facilities for producing the units according to the design. In many cases the designer's ideal has been incapable of achievement even by hand work, which is laborious and costly, at best. And even where a semblance of the desired result has been obtainable by the use of hand tools, the result has been crude compared to the machine-finished surfaces of other parts of the unit.

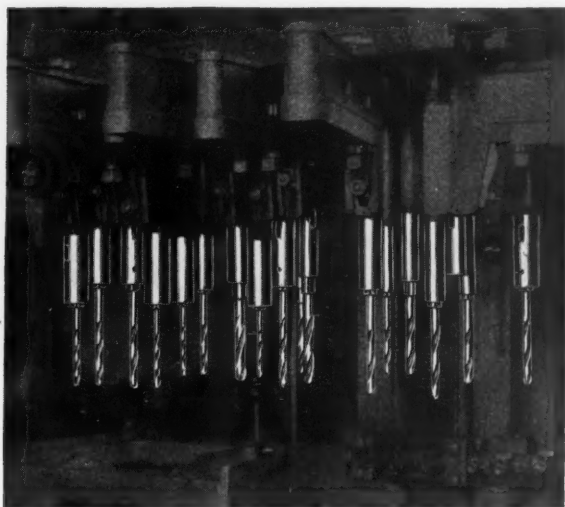
The first rule of the modern machine designer is, however, that anything that can be done by hand can

be done by machine—and done better—therefore it is not surprising that a mechanical unit should be produced with which many hitherto difficult tasks can be accomplished with ease. This unit is the Universal milling attachment, which is illustrated here in use on a variety of jobs.

The illustration at the top of this page, Fig. 1, shows two milling machines which, with the aid of milling attachments, have been adapted for profiling the irregular surfaces of metal patterns. Such a task could as easily be handled on a profiling machine, but the attachment makes the purchase of such a machine unnecessary. In a shop where the need for such a tool is intermittent,

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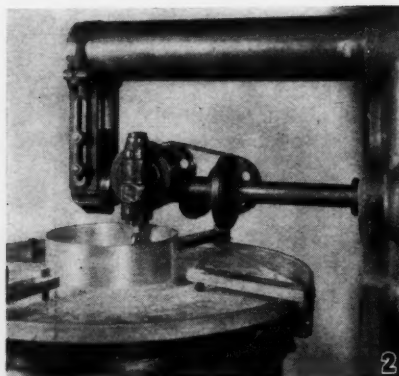
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or where floor space is at a premium, the milling attachment solves the problem very nicely. This attachment is particularly adaptable for use in the production of patterns or dies for drop forgings, as it can be adjusted to any angle desired and a straight cutter used, thus obviating the necessity for an angle cutter. The natural sequence is that a stock of cutters of various angles is unnecessary and the total inventory of cutters can be kept to the minimum.

The job shown set up in Fig. 2 is

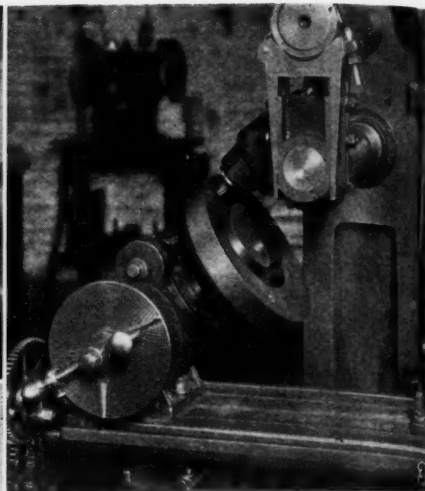


Fig. 2—The work shown here is too large to be handled in any other machine in the shop. By using the milling attachment and a rotary table, it is easily handled on this miller. Fig. 3—The first one of these cams was drilled, chiseled and filed to shape in eight hours. The remaining six were finished on this machine in four hours. Fig. 4—This job—Milling an oil groove close to an overhanging shoulder—would be difficult by any other method.

not particularly difficult, but the piece is too large to be swung in the only other machine on which it could be handled in this shop—a vertical miller. By locating the piece on a circular table attachment and using a special extension sleeve, the operation can be easily handled. With this outfit, the plain miller can be adapted for work which would be much too large for the average size vertical miller and which could otherwise only be machined by the use of a horizontal boring machine.

The piece shown set up on the machine illustrated in Fig. 3 was one of seven cams which were to be used in special machines for use in a piano factory. The first cam was made by the old-fashioned method of drilling,

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chiseling, and filing, the job requiring eight hours. As the need for the cams was urgent, the milling attachment shown in the illustration was procured and applied to the horizon-

by hand, using a hammer and cape chisel, but such a job would have been rough and irregular, both as to width and depth, and the operation would have been slow. By using the

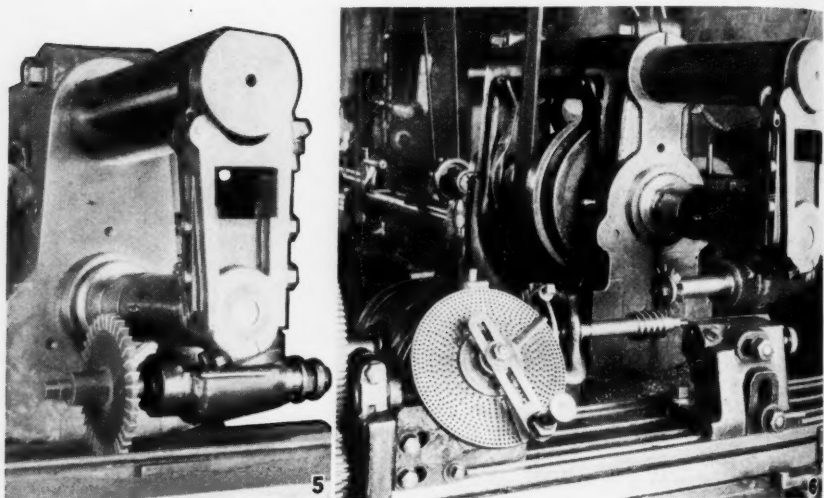


Fig. 5—Here the attachment is shown adapted for milling a $7\frac{1}{2}$ -in. radius in a cast iron part for an ironing machine. Fig. 6—Milling an 8-P steel worm for an experimental job.

tal milling machine, as shown, together with an index head to hold the work. The remaining six cams were finished in four hours. Thus not only was a remarkable saving in time made by the use of the attachment, but there was no comparison between the two jobs as to accuracy and finish.

An example of the type of job which is practically impossible of accomplishment without a tool of this kind is shown in Fig. 4. The operation is that of milling oil grooves $\frac{1}{8}$ -in. long in the surface of a machine part, the end of the groove being located close to a shoulder under a flange of 30 degrees angle. It would, of course, have been possible to chip the grooves in these parts

attachment shown, each groove was completed in three minutes.

A still more interesting application of the milling attachment is shown in Fig. 5, where the tool, applied to a plain miller, has been swung to the horizontal position so that a radius can be milled in the work as shown. The piece is a cast iron shoe for an ironing machine, and the cutter is a $7\frac{1}{2}$ -in. diameter side mill. The radius is milled the entire length of the piece for which, without the attachment, a milling machine with 24 in. table travel would have been required. The operation was performed with the equipment shown, however, without difficulty.

The flexibility of the attachment is clearly shown in Fig. 6, where the

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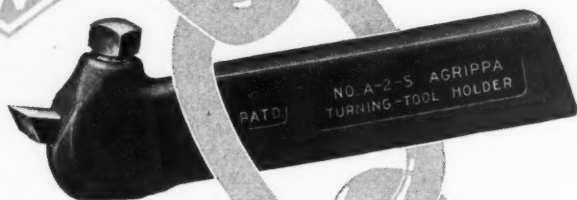
New Y

TO

The Vital Link

"AGRIPPA" HOLDERS
for all regular operations:—

Turning,
Threading,
Boring,
Knurling,
Planing,
Cutting-off,
Side work



You may pay \$3,000 for a lathe and 30 cents for a cutter-bit—a vast difference in investment—yet each one represents the acme of productive efficiency, providing the vital link is efficient, too.

Your tool holder is the vital link. Choose it with the same care you exercise in buying a lathe. In Williams' "Agrippa" Holders are many superior and exclusive features. It will pay you to investigate them.

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"The Drop-Forging People"

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WILLIAMS
SUPERIOR DROP-FORGED TOOLS

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TOOL HOLDERS
"THE HOLDERS THAT HOLD"

operation of milling an 8-P. steel worm for an experimental job is shown in process. To assume that this equipment is as efficient for cutting gears as the gear cutting machine would be an error, but for tool or experimental work, where one piece of a kind is to be made, the milling attachment is highly efficient. Many other toolroom jobs are rendered simple by the use of such a tool; the milling of keyways in shafts or other parts, especially where the keyway is of an odd width; cutting oil grooves or boring holes in vertical or horizontal surfaces; and so on. With such equipment, the shop problem of yesterday becomes the commonplace of today, the plant executive is relieved of the task of finding ways and means to perform difficult operations, and the machine or tool designer can take more liberty in matters of design, knowing that intricate operations are now possible of accomplishment without exorbitant costs.

Dissolving Metals With Mercury

By R. H. KASPER

MERCURY, also known as quicksilver, will dissolve many metals and can be combined with them to form alloys which are known as amalgams. This action is made use of by industry for the separation of metals, and, in many cases, the amalgams have found application in various trades and professions. The most common metals which combine with mercury to form amalgams that are useful to the industries are tin, copper, cadmium, bismuth, silver and gold. Tin amalgam is used for silvering mirrors, silver and gold amalgams are used for silvering and gilding, zinc and tin amalgams are used

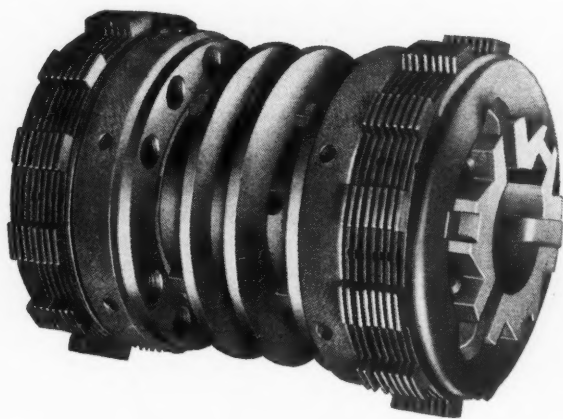
in electrical machinery, while copper and cadmium amalgams are used by the dental profession. Some of the amalgams are used as metal cements, as they are plastic when formed, but harden after a short interval of time. The process of amalgamation is used to separate some metals from their ores.

Some amalgams are formed by direct contact of the metal with the mercury, while others are formed by placing the metal and mercury together in dilute acid. An interesting application of amalgamation by direct contact is the process of unsoldering iron parts which are so located that heat cannot be applied. The application is made either by building a pool or basin around the joint and filling it with mercury, or by repeatedly pouring the mercury over the joint. The solder, which is an alloy of tin and lead, both of which amalgamate, will be dissolved while the iron, which does not amalgamate by direct contact, will remain unaffected and can be resoldered without difficulty.

Power Speed Reducers

(Continued from page 13)

meter, with $6\frac{1}{2}$ inches of square thread, driving a bronze or cast iron worm gear that is $15\frac{3}{16}$ in. diameter by $1\frac{1}{2}$ in. thick. The center of the gear is bored to 7 in. diameter, to take a barrel that is 7 inches long, which contains a hexagon opening for the driving nut. The barrel carries a flange that is both riveted and electric welded to the gear. The nut is of bronze, is also 7 inches long, and contains a square thread to fit the draw bolt. Only two men are required to set up and operate this equipment, whereas from four to six men were required when using the old-type equipment.



Now a Complete Line

BY the time you read this, the full line of Twin Disc C. C. machine tool clutches will be in production, and we shall be able to fill your orders for clutches with effective diameters as follows:

2", 2½", 3", 3½", 4", 4½",
5", 5½", 6", 7" and 9"

C. C. clutches are available both in dry plate type, with compressed asbestos drive plates—and in oil sprayed clutches, with alternate bronze and steel plates. The same compact design is used in both types, with the entire operating mechanism in the hub. Write for engineering data.

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Mr. W. L. Dixon

TULSA, OKLA.
1645 East 16th St.
Mr. R. R. Sloan

Preventing Man and Machine Idleness

-By J. J. BERLINER, B.C.S.

Senior Member of the National Accounting Systems

HOW much waste does the lost time of both men and machines in your plant represent? Can you answer this question off-hand? Take a trip through your plant and try to estimate what this apparent insignificant phase of your plant's workings amounts to in dollars and cents. The management of one company realized what this idleness amounted to and organized, through their employment, ways and means to reduce it to a minimum. Their efforts have been successful and I will outline the manner of operation.

The first step consisted in laying out a program, as follows:

1. Survey of present conditions.
2. Report of findings.
3. Recommendation for action and plan for organization.
4. Organization.
5. Operation.
6. Report of results.

The production manager appointed a man who had been trained along mechanical and scientific management lines to carry out this plan; he was added to the personnel of the employment department under the supervision of the employment manager. His office was to be "Balance of labor and production clerk." He was instructed to spend at least one month, or more if necessary, on his survey of present conditions, and as much time as necessary to obtain results on the balance of the plan.

1. Survey of Present Conditions

Every department of the production

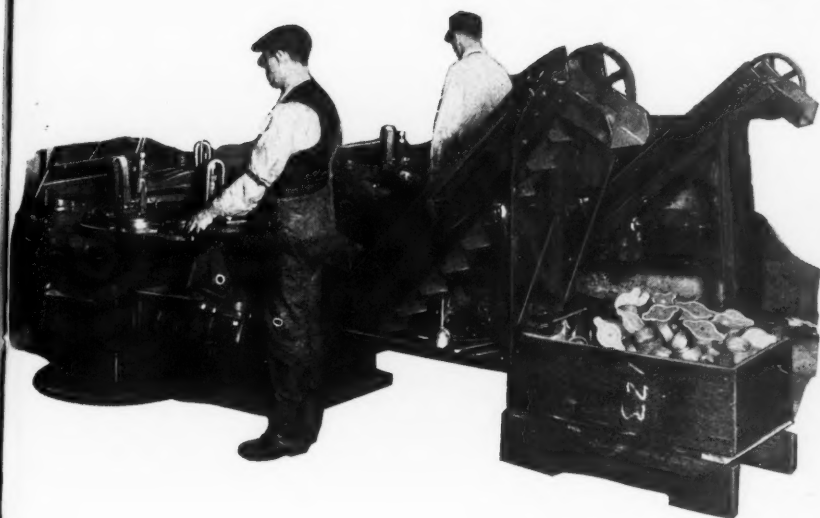
office was studied in detail as to its management, operation and relation to other departments, with special emphasis on the control and despatch division. After mastering this, shop conditions were studied, foremen and workmen were interviewed for their opinions as to present conditions and were asked for suggestions how they could be improved.

2. Report of Findings

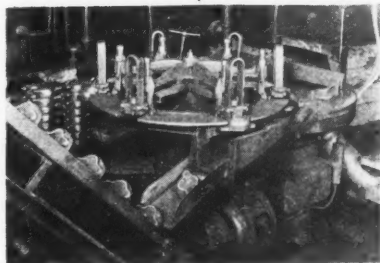
It was found that there are four main causes of idleness of both machines and men. These were again subdivided as to more definite causes as follows:

A machine would sometimes stay idle for days and then again for weeks before it would be put into operation. There was no way of checking back to see if this machine could help out some other machine of the same kind that was overburdened with work. Machine breakdowns were not closely checked to see that the machine was placed in operation as soon as possible. If it was for "man-cause," there were no substitutes or understudies available to keep the machine running. If it was for tool troubles, there were no means of determining the nature of the trouble, nor any standard remedy. If it was for material trouble, there were no standard remedies.

Although the plant has been operated under scientific principles and had reached a relatively high standard of efficiency, still careful investigation disclosed that there were sev-



18 per minute from each machine!



THE bases of a world-famed shock absorber are ground semi-automatically on the two special No. 86-30" Gardner Grinders illustrated here.

Each machine is equipped with a special rotary-type work carrier which brings the work into contact with the grinding member, the operator being required only to place the castings into loading position. After grinding, they drop off by gravity into the conveyors shown.

The bases are drop forgings, and they are cleaned up to get a commercially flat seat from which all subsequent operations are pugged.

PRODUCTION: 18 pieces per minute.

GARDNER GRINDERS are producing at equally high rates, in all branches of the metal-working industry—

ASK FOR DESCRIPTIVE BULLETINS!

GARDNER MACHINE COMPANY
(Specialists in Grinding Equipment)

428 East Gardner Street

Beloit, Wisconsin, U. S. A.

No. 1

Date of
Last job

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JUST OFF THE PRESS!



*"LOGAN Air Operated
Devices Save Time,
Effort and Motion."*

A New "LOGAN" AIR EQUIPMENT CATALOG

It contains 64 pages of useful information, sectional drawings, with complete engineering dimensions, and describes many improvements on the various LOGAN Air Operated Devices.

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Send me a copy of the New Logan Catalog No. S-25.

Name Title

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number, and above each square the number of each work day of the month.

C. On the left hand margin was placed: (a) department name (signified by symbol as A. F., Full Automatic); (b) machine number and location symbol; (c) one line skipped between machine groups in a single machine class, and three lines between different machine group classes; (d) machine classes arranged in alphabetical order.

D. Information as to machine location and groupings was procured from the machine and material location book, which is kept up-to-date by the tool and operation department.

E. New sheets made every month.

F. Sheets ready to be drawn off the board to be placed in a suitable book in numerical and monthly order for future reference.

Machine Burden

A form size 8x11 inches was printed and called the "Red Tag Report," this form ruled and provided with spaces for machine's number and symbol, number of red tags (work behind schedule), number of regular jobs, date of first job, and date of last job. (See Figure 1). Each month these reports are prepared by the employment department as follows: Using duplicator ribbon, number each sheet from one up, place in column for machine number and symbol, the number of symbol of each leader machine in each group to be arranged as on the idle machine board. A sufficient number is duplicated to last one month. These forms are delivered to the despatch department, which will deliver to the employment department not later than 9 a. m. the following morning a complete report

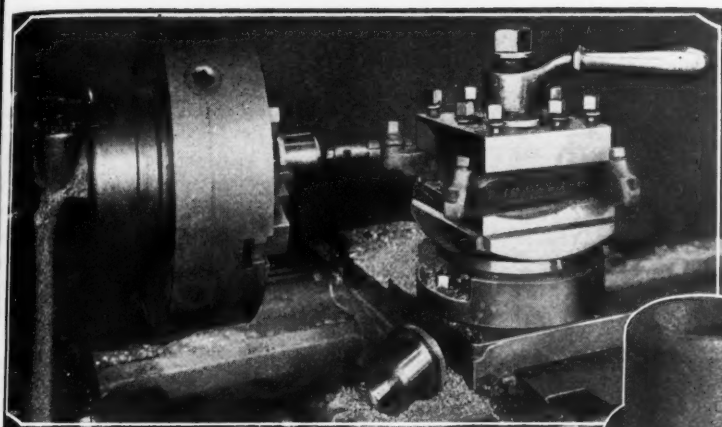
of the jobs that are available in each department.

Idle Machine Tickets

A form was devised in duplicate to include all the causes for machine idleness as mentioned in a preceding paragraph, so that it is necessary only to check the cause for idleness that fits each individual case. This ticket is called the "Idle Machine Record," and space is reserved for time clock records so that the lapse of time shall be recorded. In upper right hand corner, space is allowed for machine number and symbol and elapse of time in hours and tenths at the bottom is placed the procedure for each man who is directly concerned, with space at the right for his signature. (See Figure 2.)

Red Tag Analysis

To provide a "red tag analysis" a form was drawn up to show sheet number, department number, number of machines in group, number of red tags, drawing numbers, number of parts, operation number, lot numbers, number of lots and their dates. This analysis is drawn from the despatch cage each week to give a synopsis of the amount of work behind schedule and the exact stage of completion; that is, where it is and how near completion. These analyses are given to the production manager, his assistant, the factory superintendent, chief inspector, and the chief stock chaser, as a guide where to direct their most earnest effort. A comparison summary of this report is made each week by giving the total of red tags charged against each department, opposite these totals the totals of two months ago, and opposite these the percentage gained or lost, shown by a + or — sign. A grand total of all red tags in the factory is shown and its percentage



McCrosky Turret Cuts Production Time 40%

THE JOB—Machining all over bronze bushings. A four-way McCrosky Turret is bolted to bolt circle of a modern engine lathe. At one set-up three different tools required are mounted in the turret.

The line drawing shows the required order of operations: 1—Rough-turn diameter of sleeve; 2—Rough and finish bore; 3—Finish-turn diameter; 4—Face inside of flange true. The McCrosky Turret enables the operator to swing each tool into position without stopping his lathe. The patented, positive indexing mechanism takes care of the extreme accuracy required.

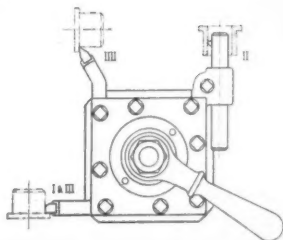
Customer's Verdict: "Our McCrosky Turret has enabled us to rig up an engine lathe to give production almost equal to a special turret lathe set-up. It has saved us 40% in production time on this job."

Bulletin No. 11-C tells the whole McCrosky Turret story. Send for a copy.

McCrosky Tool Corporation

MEADVILLE, PENNSYLVANIA

Branches in Cleveland, Detroit, Chicago, Toronto



Returned Issued		Machine Symbol Located In Dept.	
Idle machine record		Elapsed Time	Hours Tenths
MACHINE		TOOLS	
Break-down		Fixture lacking	
Under repair		Fixture defective	
Power shut-offs		Supplies lacking	
Belt breakage		Supplies defective	
		Tool release lacking	
MAN		MATERIALS	
Absent		Not up to machine	
No operator assigned		Urgent on preceding machine	
Reg. Opr. on other work		Ahead of schedule	
		Up but no orders	
		Up but no inst. card	
DISPATCH CLERK—Issue, Mark Cause, Send White to M.W., Post Yellow.		Issued By	
MASTER WORKMAN—Verify and Return to Dispatch Clerk		Verified By	
DISPATCH CLERK—Compare and when agreed send to Emp. Dept. to be Posted.		Posted By	

Fig. 2—Idle Machine Ticket.

gained or lost shown by the + or — sign. This summary is a key, to direct attention to the departments that are lagging behind.

Idle Man Ticket

For this purpose a form is used which is constructed similar to the idle machine record but is of different color, with instructions on the reverse side as to the way to use it, why it is given, and the time limit of a single idle time ticket (See Figures 3 and 4).

Idle Man Records

On graph sheets as used on the idle machine board, a graph curve is constructed to show the amounts of idle time separated to the four main reasons; tools, machine, materials, in-

structions. Separate curves are constructed for each department. The time is calculated by the week, a summary made and the totals added to the graphs. This gives a graphic condition of the idleness, the department in which it is most pronounced and the cause.

Processes

A questionnaire is used which gives the employee's name, department number, address, telephone number, married or single, nationality, whether or not he is an American citizen, different languages he speaks, educational record, the number of operations he is capable of performing and an affidavit from his foreman as

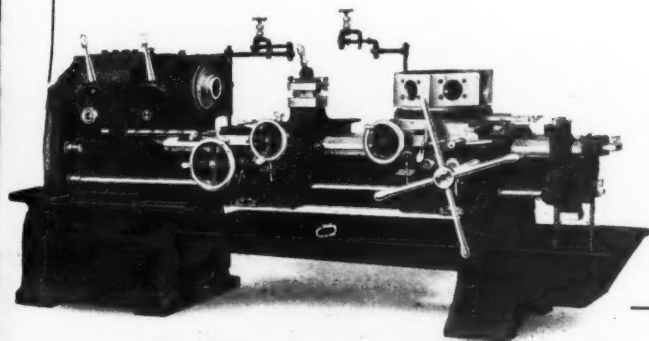
When Your Operator Goes Walking...

It Costs You Money!

EVEN if he only walks from the operating position to the head of a turret lathe to make feed changes—*it costs you money!*

The CINCINNATI-ACME Universal Turret Lathe with Duo Control, converts this walking time into productive working time. The operator, from the working position, makes all feed changes at the apron. *He doesn't have to walk!*

This is just one feature of the CINCINNATI-ACME Universal Turret Lathe. Write for a bulletin—it gives all the features!



The Acme Machine Tool Co.
CINCINNATI, OHIO

verification of all the facts. All operations used in this factory are listed with a space for the length of time worked as follows:

	Yr.	Mo.
Engine Lathe Opr.		
J. & L. Opr.		
Lo-swing Opr.		
Hd. Screw Opr.		

In a Rand file, cards giving man's experience are recorded in department numerical order. These operations are also cataloged in a separate file under operations, where all employees who can operate a J. & L. will be catalogued under head of "J. & L.," all men who can operate an engine lathe under head of "Engine Lathe," and so on. If it is necessary to shift a man who becomes idle to another job, we know from the Rand file where we can use him to advantage, or if we need a J. & L. operator on quick notice we can refer to our cataloged operation file and find an available man. By this method we always work within our force and hire in at the bottom only semi-skilled or unskilled labor, thus reducing our skilled labor turnover to a minimum. In times of work fluxuation in various departments we can shift surplus labor to or from departments with a greater degree of accuracy and discretion.

4. Organization

The plan for organization was approved by the production manager and carried out as outlined above.

5. Operation

A. An idle machine board was constructed as outlined above.

B. Idle machine tickets were made up, printed in duplicate, alternating white and yellow.

C. The despatch department is instructed to issue an idle machine

ticket when a machine goes idle. mark cause of idleness, send white copy to the department foreman, post yellow in machine rack, instruct the foreman or clerk to verify as to machine number and cause for idleness, and return to despatch department. The latter will then send to employment department when agreed as to cause of idleness. The employment department will post this idleness on the idle machine board as follows: (a) Idleness is posted under date headings, and opposite corresponding machine numbers. (b) Idleness is shown by color as follows:

Labor	Red
Material	Black
Absence	Yellow
Tools	Blue
Machine	Green

(c) On completion of posting, the tickets are placed on file for a period of two months.

D. Construct and deliver to the despatch department the red tag report blanks as outlined above. Instruct despatch department to draw off a report each work day that will contain such information as the number of red tags, number of regular jobs, with date of the first and last job of each machine group as outlined in the report. These reports to be delivered to the employment department not later than 9 a. m. the following morning. The idle machine board poster will record in the respective square opposite the department number and under the correct date, the number of red tags in the right-hand small square and in small numbers the number of regular jobs above the left-hand small square with the two dates in the left-hand small square. After posting, the report is turned over to the idle machine board supervisor who makes the necessary

Sheffield Jessop's ALLOY "C" STEEL

is the

NON-ABRASIVE — NON-DEFORMING
HIGH PRODUCTION

TOOL and DIE STEEL

universally in use because

1. It is supplied in a condition permitting of easy machining and filing.
2. It resists scaling on heating and corrosion under moist atmospheric conditions.
3. It hardens in either air or oil, and is non-changeable.
4. It retains cutting hardness after several regrinds.
5. Its resistance to abrasive wear is so great that it has been called the peer of high production steels.
6. Last but not least—it is made from the very best of base materials which Jessop's consider so necessary in the manufacture of all their tool steels.

A very interesting leaflet on this remarkable cutting and wearing steel has been prepared for you. Write any of our branches below.

William Jessop & Sons, Inc.

NEW YORK
121 Varick Street

BOSTON
163 High Street

CHICAGO
1857 Fulton Street

DETROIT
8116 Tireman Avenue

Returned		Hours	Tenths
Issued		Rate	Amount
CHG.			
IDLE MAN TO F. No. 115			
Machine Symbol	Man's Name	Man's No.	
TOOLS		MATERIALS	
Lacking, or missing		Lot incomplete	
Defective, or faulty		Tags missing	
Delayed for grinding		Not up to machine	
Delayed for supplies			
MACHINE		INSTRUCTIONS	
Breakdown		Lacking, or missing	
Repairman working on		Defective, or incomplete	
Belt troubles		Error of clerk or man	
Power shut-offs		Inspection troubles	
Setting up machine		Job cards missing	
REMARKS:			
INSTRUCTIONS—Check carefully item causing delay. Use "Remarks" only when reason not covered by any of above.		Foreman	
		Dispatch Clerk	
		Rat. Div.	

Fig. 3—Idle Man Ticket.

notes, then it is to be filed for a period of two months.

E. When necessary, report to the production manager all doubtful cases so that corrective action can be taken.

F. Idle man tickets are to be handled as outlined for idle machine tickets, and delivered to the employment department not later than 9 a. m. the following day. The time limit of an idle man ticket is one hour and if at the end of that time the man is idle, the despatch depart-

ment will send the man to the employment department, which will consult the operation file, and send him to a department where the need for men permits and where he will produce according to his ability. The despatch department will be notified by a temporary transfer where the man is to be sent, and when production conditions require the man's return the despatch department will be notified by a temporary transfer where the man is to be sent, and when production conditions require

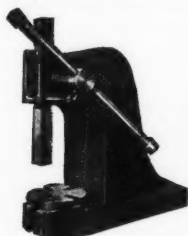
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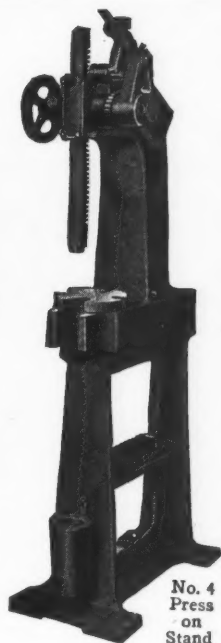
No. 1 Press



No. 2 Press



No. 3 Press

No. 4
Press on
Stand

SHELDON Arbor Presses

DESCRIPTION—Sheldon Arbor Press frames are made of semi-steel, the metal being properly distributed, giving a light and exceptionally strong casting. Rams and pinions are made of alloy steel, heat-treated. Large stub tooth is used. Rams are square, carefully fitted, insuring proper alignment.

Nos. 1 and 2 presses are furnished only with plain levers. No. 3 presses are furnished either plain or ratchet levers. No. 4 presses only with compound levers.

Floor Stands can be furnished for our No. 3 and No. 4 presses. They are made of semi-steel, are well ribbed and of heavy construction. They are provided with removable shelves and wood pots for catching mandrels, tools, etc.

— SPECIFICATIONS AND PRICES —

Ask for Complete Catalogue	No. 1 Press	No. 2 Press	No. 3P Press	No. 3R Press	No. 4 Press	No. 3 Floor Stand	No. 4 Floor Stand
Largest dia. will take.	7"	12"	16"	16"	20"		
Largest dia. mandrel.	1"	1 1/2"	2 1/2"	2 1/2"	3"		
Height over plate.	4 1/2"	8 1/2"	14"	14"	18 1/2"		
Max. height will take.	5"	9 1/2"	15"	15"	19 1/2"		
Size of ram (square).	7/8"	1 1/2"	1 1/2"	1 1/2"	1 1/2"		
Length of ram.	7 3/4"	13 1/2"	21"	21"	26"		
Movement of ram.	5"	9 1/2"	15"	15"	20"		
Leverage.	25 to 1	35 to 1	48 to 1	72 to 1	100 to 1		
Pressure on ram (tons)	3/4"	2	5	7 1/2"	10		
Height.	9 1/2"	17"	26"	26"	33 1/2"	35"	30"
Dimensions of base.	4"x10"	6 1/4"x17"	8"x20"	8"x20"	8"x24"	14"x22"	14"x25"
Net weight.	19 lbs.	75 lbs.	150 lbs.	215 lbs.	320 lbs.	145 lbs.	185 lbs.
Weight crated.	20 lbs.	85 lbs.	170 lbs.	240 lbs.	360 lbs.	150 lbs.	195 lbs.
Price, F.O.B. Chicago.	\$10.00	\$20.00	\$30.00	\$40.00	\$75.00	\$20.00	\$30.00



No. 3-R Press

SHELDON MACHINE CO.

3251 COTTAGE GROVE AVE.

CHICAGO, ILLINOIS

the man's return the despatch department will notify his temporary foreman, who will send him back to his regular department. Idle man records are to be maintained as outlined in a preceding paragraph. Reports are

system was in operation the idleness decreased 50 per cent, and has been steadily decreasing every month. An absolute check on red tags (work behind schedule) is made possible. Red tags are kept to a minimum, as it is

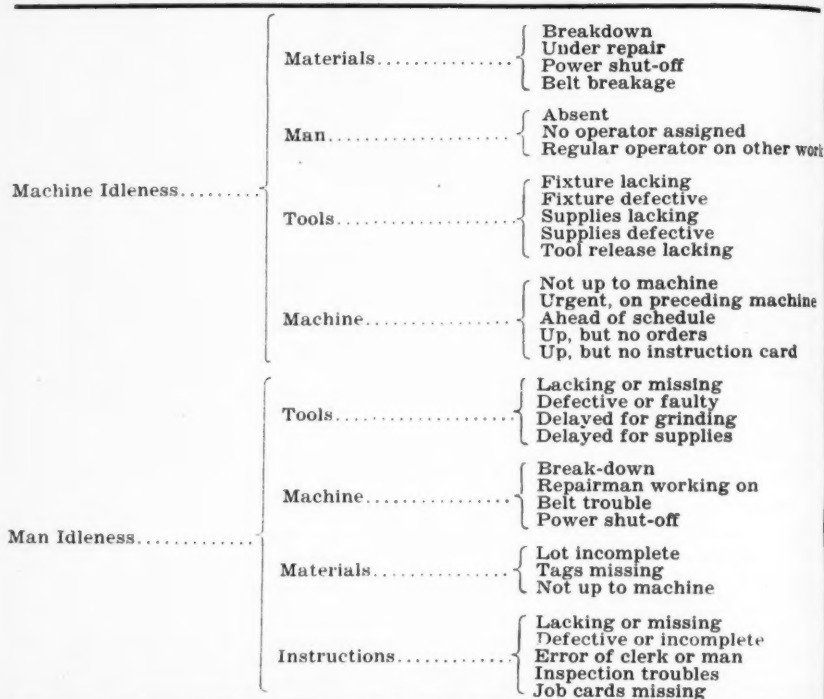


Fig. 4—Causes of Man and Machine Idleness.

to be made to the production manager if there are any doubtful cases, or if any department has an exorbitant amount of idle man-time charged up to it.

G. When it becomes necessary to change the sheets on the idle machine board, the old sheets are to be placed in a suitable book with regard to months and sheet numbers.

6. Report of Results

The first three months that this

easy to plan a re-routing of the flow of work to the machines which are idle for lack of work or are not heavily burdened. It keeps the production manager posted on the condition of the factory at all times, and shows the employment department where the need for men is the greatest. See Figure 5 plotted for a typical month.

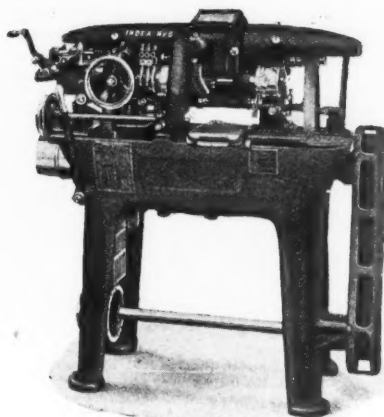
To show a graphic condition of the work behind schedule in the entire factory we compiled all the data we

(Continued on page 112)

Maximum Screw Machine Production

Guaranteed On the Index-O

HIGH PRODUCTION AUTOMATIC SCREW MACHINE



Maximum
Chuck
Capacity,
 $\frac{7}{16}$ "

Maximum
Feeding
Length,
 $1\frac{1}{4}$ "

The Index-O is designed to obtain the maximum cutting speeds of the new steels and cutting materials.

It is built especially for High Speed Production.

It will operate at higher speed with less vibration, wear and tear than any similar machine.

It is exceptionally economical on short runs, due to a standard cam system.

It takes less time to set up on the Index-O.

Send your blue prints for production estimates—without obligation.

INDEX MACHINERY CORPORATION

49 CENTRAL AVENUE, CINCINNATI, OHIO

Machining Parts for Wright "Whirlwind" Engines, V

By PHILIP WINTER

THE crankshaft for the Wright "Whirlwind" Aviation Engine is a two-piece, single throw, counter-balanced assembly, machined from nickel-steel forgings. The front section of

clamping cap screw. The prop end of the crankshaft is splined to receive the thrust bearing nut and the nut which holds the front bearing in place when assembled.

The rear crankshaft is bored at one end to receive the crankpin, the operation being performed in the turret lathe shown in Fig. 36. The rough boring of the hub, and the facing of the hub and crankcheek take place simultaneously, the rough boring and turning operation being performed with the single point tools shown project-

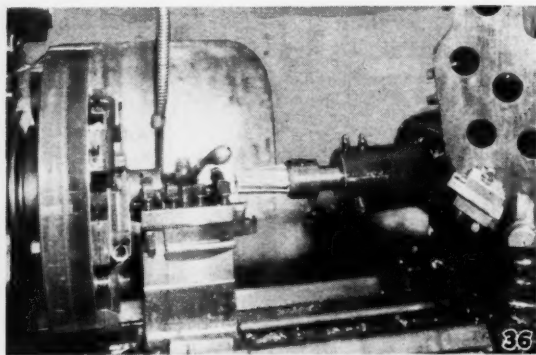
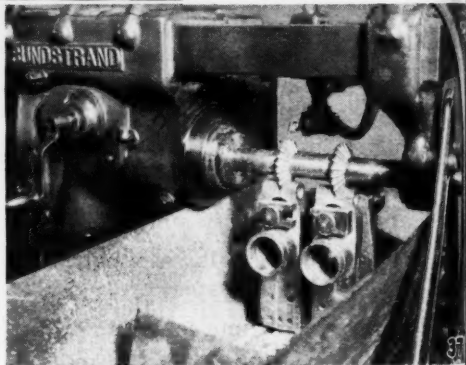


Fig. 36—Turning, boring, and facing the rear section of the crankshaft. Fig. 37—Milling V-slots in crankshaft rear sections, using a Rigidmil and two 60-degree angle cutters.

the shaft consists of the shaft proper, the front crankcheek with its counterweight, and the crankpin. The rear section consists of the rear crankcheek with its counterweight and the rear main bearing hub.

The shaft proper and the crankpin are bored throughout their length for lightness except at the rear of the crankpin, where a heavy circular rib is provided to prevent distortion when the rear section of the shaft is clamped to the crankpin. The crankpin is provided with a straight groove to receive the



ing from the turret at the right of the illustration. The facing tools are held in the turret toolholder mounted on the lathe cross slide. The finish boring operation is performed with the

(Continued on page 69)

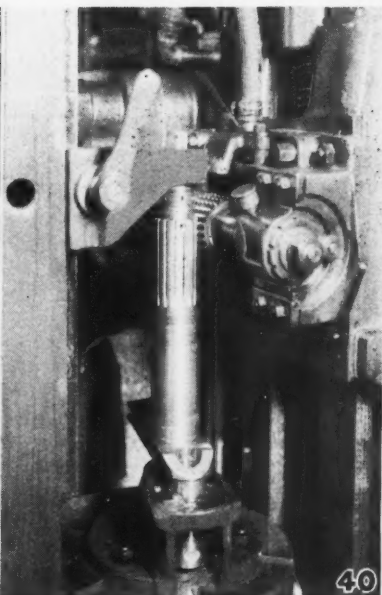
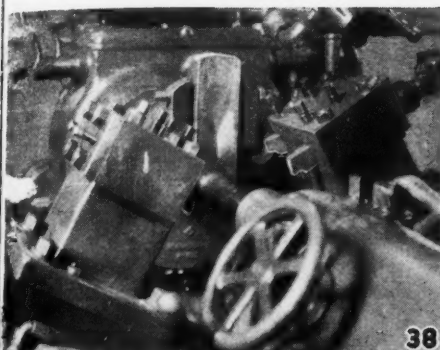
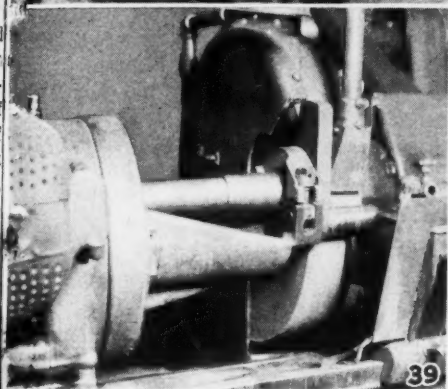


Fig. 38—Turning and facing the front crankshaft section in an automatic lathe. Fig. 39—The crankshaft pins are finished to size in this Norton grinder. Fig. 40—Splining the rear end of the crankshaft for the propeller hub.



Machining Wright Engine Parts

(Continued from page 64)

Eclipse multi-diameter cutter shown in position in the illustration. Approximately .012 in. is left in the hub for grinding.

The illustration Fig. 37 shows the operation of milling V-slots in two crankshaft rear sections, for which a "Rigidmil" and two 60-degree angle cutters are used. The sections are bolted to an angle plate fixture, locating by the crankpin holes. The object of this operation is to lessen the weight by the removal of stock where it is of no value, and improve the appearance of the engine. The machine works semi-automatically,

feeding at rapid traverse to cutting position, feeding at cutting speed until the cut is through, and then reversing at rapid traverse speed to loading position, at which point the table stops. After the machine has been set up, the operator is required only to change the pieces.

The crankpin, which is a part of the front section, is rough turned and faced to length in the LeBlond automatic lathe shown in Fig. 38, the front crankcheek being faced in the same operation. The two tools in the rear toolblock perform the facing operations while the turning operation is being performed by tools held in

the front toolblock. The piece is swung between centers, the crankcheek locating between two jaws which are integral with the driving head. Setscrews in the jaws provide for locking the crankcheek rigidly in position. Approximately .030 in. is left to be removed in the grinding operation.

The crankshaft pins are finished by grinding to size in the Norton cylindrical grinding machine shown in operation in Fig. 39. The piece is held by clamping in a fixture, aided by the tailstock center. The pin is finished to drawing size within $\pm .001$ inch.

The machine shown in Fig. 40 is a hobbing machine, set up to spline the rear end of the crankshaft for the

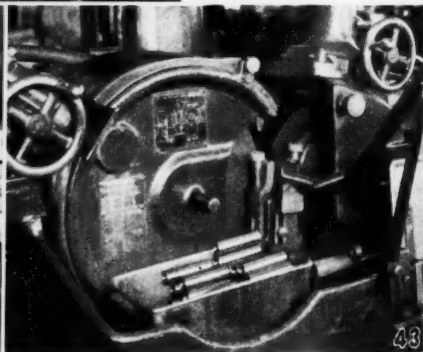
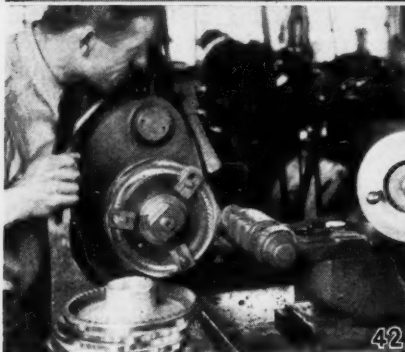
propeller hub. The shaft is located and held by a screw-center at the upper end, the lower end being clamped in a fixture in which the necessary amount of "throw" is provided for. Sixteen splines, five inches long, are cut in the shaft, the width of each spline being held to a limit of $\pm .0005$ in. A shaft is splined, complete, in forty-five minutes, which makes it possible for one operator to take care of several machines.

Each shaft used in a Wright airplane engine must pass a rigid inspection to make sure that the dimensions come within the required limits, that the workmanship is perfect, that the shaft is straight, and that it is perfectly balanced. A shaft in process

of inspection for straightness is shown in Fig. 41, where the variety of precision gages and tools required for



Fig. 41—Each shaft is subjected to a rigid inspection before it is assembled to the engine. Fig. 42—The cams are ground to shape and size within .002 inch. Fig. 43—Wristpins are finished in the Centerless g.inder.





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Fig. 44—View of one side of the motor assembly department.

inspection can be seen on the inspector's table.

The valves on the "Whirlwind" engine are actuated by a cam which consists of a hardened steel ring carrying a double row of lobes and an internal gear. The cam ring is rivetted to an aluminum hub. The cam is finished to the shape and size desired by grinding in the machine shown in Fig. 42, where a piece can be seen in process. The mechanism by which the work-spindle is actuated is so constructed that it feeds to and from the wheel with a reciprocating motion, the action being governed by a master cam and roller in the head-stock mechanism. With this equipment the cam is finished to specifications within .002 inch.

The wristpins are of steel, cut to length, hardened, and finished to size by grinding in the centerless grinding machine shown in Fig. 43. The pins are fed to the machine by means of a trough, into which they are placed so that they are carried to the wheels by their own weight. The action of the grinding wheels feeds them through and finishes them at the same time. A total of .015 in. of stock is removed, the pins being

passed through the machine five times. A net production of from 75 to 200 pins per hour is obtained, and the diameter of the pins is held to a limit of .0002 inch.

Figure 44 shows one side of the final assembly department, which is laid out so that the motors travel down one side of the room, each starting as a crankcase in position on a motor stand and finishing at the opposite end of the room as a complete motor. The motor stands are guided by means of a track set into the floor, as shown. The benches upon which the small parts are finished and assembled into minor assemblies are arranged crosswise of the room, at right angles to the motor assembly line, which makes it possible for the material to start at one side of the room and finish at the other side at the point where it is to be assembled to the motor. When the motor leaves this department, it is ready for testing.

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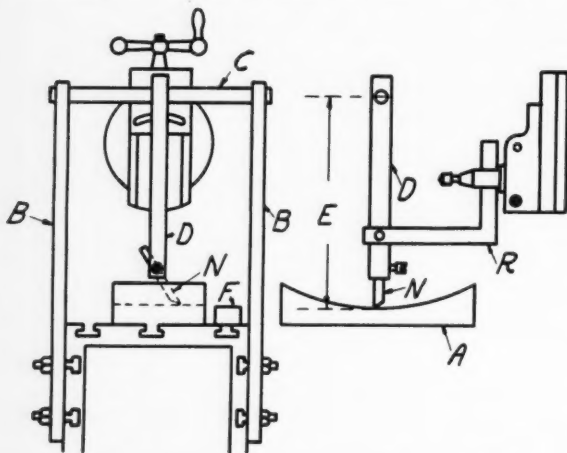
Machining a Radius With the Shaper

By CHARLES KUGLER

ONE of the jobs that came into our shop recently consisted of machining a 12-inch radius in the

er table, as shown. Suspended from shaft C is the bar D, which carries the tool N; the combined length of the bar from the center of the shaft hole to the end of the tool, indicated as E, being the dimension of the radius. In order to simplify the task of setting or re-setting the

tool, the block F, the top surface of which is the required distance from the center of shaft C, is clamped to the machine table. The necessary connection between the tool and the shaper-ram is provided by the angular bar R, which is clamped in the tool post and to which the bar D is bolted. By using this attachment a radius can be machined as easily as though it were a flat surface.



Attachment for Machining a Radius with the Shaper

surface of each of a number of cast iron blocks. As there was no lathe available large enough to cut a radius of this size, we decided to machine the blocks in the shaper, using the attachment illustrated in the drawing.

The work is indicated at A. The frame of the attachment consists of the two vertical supports BB and the horizontal shaft C, the side pieces being bolted to the sides of the shap-

A Flexible Punch Shank

By PAUL A. BARD

THE punch holders used by one large maker of metal stampings were formerly made with shanks which were cast integral or solid with the punch holders. In course of time, due to the wide range of work going through the shop and the wide variety of punch presses in use, he decided to change from cast punch holder shanks to machine steel shanks.

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These steel shanks are screwed into the punch holder and it becomes a simple matter, of course, to remove the shank and replace it with one that is longer or of a smaller or larger diameter, according to the requirements of the press. Machine steel shanks, however, work loose due to vibration and side pressure during forming, piercing or blanking operations, and it became necessary in consequence to dowel the shanks in position, so that they could not work loose.

The use of dowel pins, however, had the objection that once they were put in, they were difficult to take out, thus interfering with the flexibility which it had been aimed to obtain by the use of steel screw shanks. This company now uses socket head set screws instead of dowel pins. These socket head set screws can be tightened, of course, with a hexagonal wrench. There are no protruding heads to get in the way and removing the set screw and shank becomes a very simple matter. These shanks cannot turn or work loose, yet they may be removed quickly and easily.

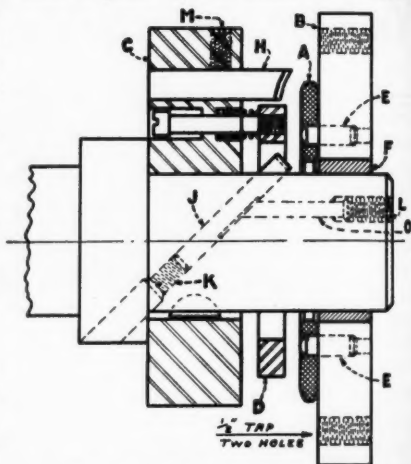
A Good Combination Tool

By H. L. WHEELER

THE tool described and illustrated in this article was designed to turn the $\frac{1}{4}$ -in. radius and chamfer the bore on the sides of the sprocket shown as A in the drawing, performing the two operations simultaneously. The work is held by the fixture B, which consists of a flat plate steel $\frac{3}{4} \times 6 \times 6$ -in., bolted to the faceplate of the machine with two $\frac{1}{2}$ -in. cap screws. In the plate are two locating pins EE, which support and drive the work. The plate is also fitted with a guide bushing F, which is a

running fit for the pilot on the tool holder.

The shank and pilot of the tool are in one piece and serve to carry the piece C, in which is mounted the tool H. The piece C is both pressed on and keyed in position to prevent it from turning. The radius tool H is held in place by the headless setscrew



Tool for Chamfering and Forming Simultaneously.

M. The chamfering operation is performed by the tool J, which is fitted to a hole that is drilled through the bar at a 45-degree angle. This tool is held in position by the adjusting screw K, a clearance hole being provided into which a screwdriver can be inserted to turn the screw. It is held from turning by the key O, locked in position by the screw L.

While the tools are cutting, the piece is held in position by the pressure ring D, which is attached to the toolblock C by three filister head screws. The pressure ring is controlled by three springs which fit into corresponding counterbored holes in the toolblock. As the pressure ring is held away from the toolblock as

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far as the heads of the screws will allow, the ring comes in contact with the work before the tools are close enough to start cutting, thus providing pressure to hold the work piece firmly against the face of the fixture **B**. The cutting oil which flows over the tools while in operation also serves to lubricate the contacting faces of the work and the pressure ring. After one side of the work piece has been machined, the tool is withdrawn and the piece is reversed so that the reverse side may be machined. The tool can be used in either a hand turret lathe or engine lathe. The work is easily removed by hand, the two locating pins **EE** being a free fit in the holes.

Transparent Templets Assist Drafting Room

By C. G. CROWLEY

AFTER the details of a die or forming job have been laid out, the final job consists in choosing a die set suitable for the job. The set selected must allow sufficient room for the die, and the punchholder and dieholder must have sufficient thickness for the die, which also means sufficient depth or thickness to provide for the necessary strength. The type of shank to be used must also be determined; whether of the solid cast type, and if so, of what diameter and length, or whether of the steel inserted type or to consist of a swivel adapter. The sum total is that in many cases the

task of drawing up a design for the die set, having the patterns made, and having the castings machined brings the cost of the die set up materially,



Danly transparent templet in use, showing ease with which a die set may be selected.

as both drafting room and tool room time is included in the expense.

A number of the larger manufacturing plants have found a way to avoid a large part of this detail and expense by using transparent templets as shown in the accompanying illustration. When using the templets, all that is necessary in order to determine the type and size of die set required is to place the templet over the drawing of the die or, where the die is made, upon the die itself. It is then a very simple matter to decide upon the type and size of die required.

These transparent templets are now being furnished to the larger users of die sets by manufacturers of standard die sets such as Danly Machine Specialties of Chicago. A complete set consists of forty-one templets, the larger ones being made in halves. In some cases, several different die sets are indicated on one templet.

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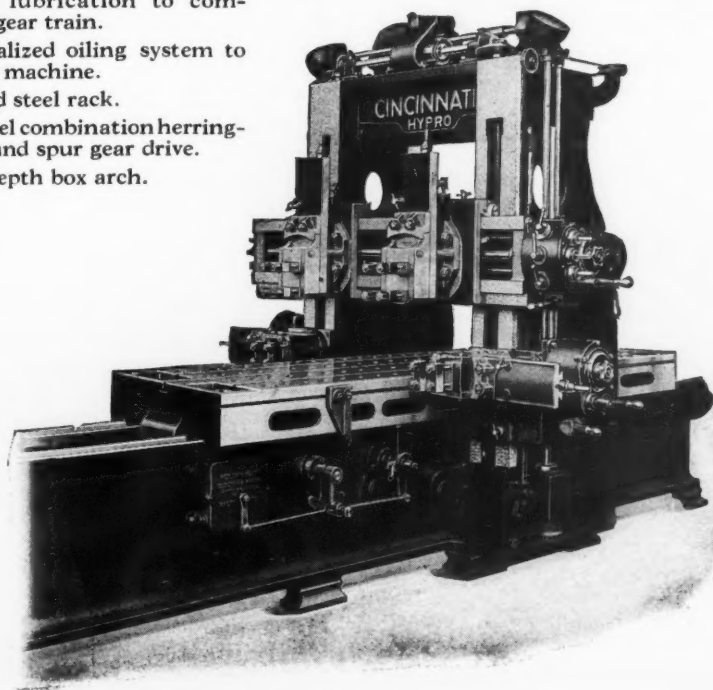
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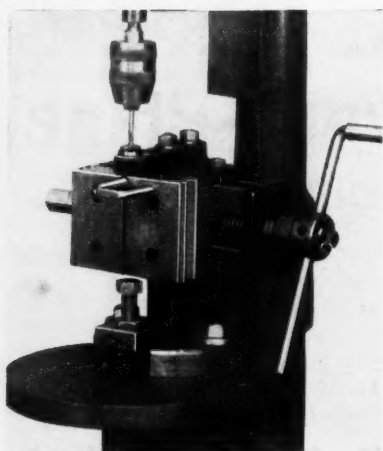
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A Tool-Clamp For the Wheel Lathe

By JOS. C. COYLE

IN machining the treads of car wheels at the Denver & Rio Grande shops in Denver, two forming tools are used for each wheel. The tread is roughed with a tool that is 16x3x2 in., the tool being held in position by two 1-in. setscrews. The finishing tool is a flat form tool, forged to shape. At the rear edge of this tool is a 1/2-in. tongue which is inserted into a slot in the toolblock, where it was formerly held by means of two 3/4-in. bolts. As considerable time was lost in changing finishing tools, however, the special clamp



A Tool-Clamp for the Wheel Lathe

shown in the illustration was made. With this clamp the tool can be removed by loosening one nut.

The clamp is made of an 18-in. length of 1x3-in. steel, bent at right angles at a point three inches from one end. The bar is bent to conform to the shape of the top of the machine frame and is drilled so that it can be held in place by a setscrew near the rear end and a bolt at the front, both of which are screwed into the frame. The straight 3-in. section extends downward and bears on the top of the tool, pressure being applied by means of the nut on the bolt.

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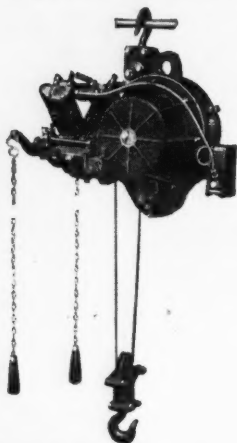


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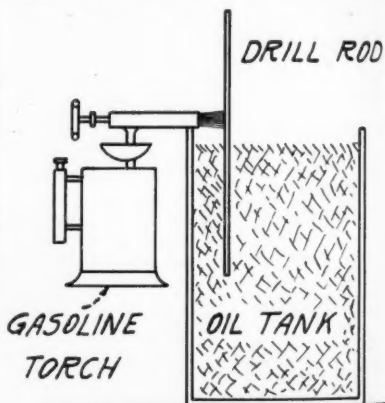
236 SOUTH JEFFERSON ST., CHICAGO

To remove or change tools, it is only necessary to loosen this nut. The rear end of the forming tool sets $\frac{1}{2}$ -in. into the toolblock and bears against the head of the machine.

Hardening Drill Rod

By CHARLES KUGLER

FINDING it necessary to harden a length of 3/16-in. drill rod, 12 inches long, several methods of performing this task were tried without success. The difficult part of the job lay in keeping the rod straight. We finally decided to try heating a small portion of the rod at a time, using a gasoline blow-torch, and found this method satisfactory. A tank was filled full of oil and the torch was held so that about two inches of the rod could be heated at a time, the heated portion being immediately quenched by lowering into the oil. While one section was cooling, the next section



Showing method of hardening drill rod.

was being heated. In this manner we were able to harden the entire rod without warping it. While this method would be too slow for production work, it is worth trying when one or two pieces are to be hardened.



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Over the Editor's Desk

Organized War On Unemployment

ACTION seems to be the order of the day as regards the unemployment problem. Finally recognized as both a local and a national calamity, and therefore of as much concern to the community and the nation as to the individual, the industrial organizations in a number of cities have organized to discover the fundamental reasons for unemployment and, as far as possible, develop ways and means to end this periodical disturbance to peace and prosperity.

The initial efforts of those who are engaged in the research upon which this investigation will be based have disclosed an almost total absence of information as to the real causes for lack of employment. In many cases, the reduction of working forces has been forced by a dropping off in orders which failed to come in as a result of some psychological condition in the minds of logical buyers. In other words, a vast percentage of the employers who reduce their outputs and, accordingly, their working forces, are governed more by apprehension as to how apprehensive the "other fellow" may be than they are by actual knowledge of the market for their products. This unwarranted and unnecessary caution can be eliminated by a fuller understanding of market possibilities and by a closer co-operation between manufacturers. It is to be hoped that the agencies which have undertaken the research work will continue to function until all the mysteries regarding markets,

the labor-capacity of industry, the relation of wages to buying power, the bugaboo of "over-production," and other related factors are cleared up.

Vacation and Perspective

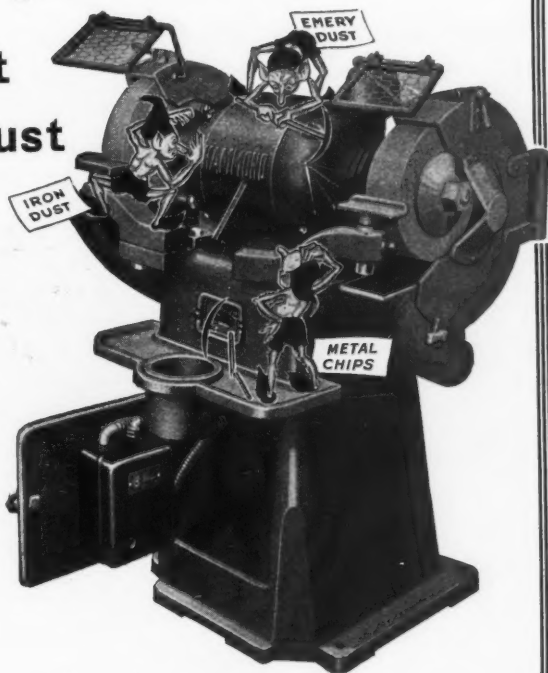
THE time is approaching when all those who can will lay aside their tools, or close up their desks, and get as far away as possible from the tasks that have occupied their energies during the past year. To the employee whose task is finished with the end of each day, this respite from labor is an opportunity for recreation and play; to the executive upon whom rests the responsibility for results from a department or a plant, it is an opportunity to obtain something that is too little regarded—a view of the job in the perspective.

Too many of us are too close to the job to see it as it should be seen. We are too engrossed in the details of the every-day task to see the possibilities in our respective jobs and to obtain a correct idea of the relation of our individual functions to the organization as a whole.

To the executive who is thoroughly sold on his firm and his job, vacation gives relief from the details and affords an opportunity for mental readjustment. The result is that he returns full of new ideas and enthusiasm, not necessarily because he is rested, but because he has been able to get far enough away from the job so that he could see it in the perspective—as a part of the whole—and thus see opportunities in it that he had overlooked before.

These Imps of Destruction

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- ..Metal Chips



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The City Machine & Tool Works, East Third at June St., Dayton, Ohio, announces two additional models of its standard line of Bolender Gear Burnishers, making available at one source

center lines vertical, the Models O and No. 2 each has the additional features of a completely automatic burnishing cycle and greater range in capacity. Model O has capacity for gears from $\frac{1}{4}$ in. to $2\frac{1}{4}$ in. dia. by $\frac{1}{2}$ -in. face width, and Model No. 2 has capacity

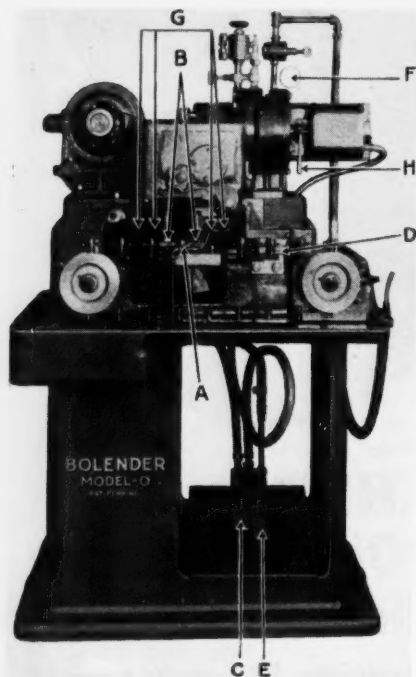


Fig. 1—Bolender Model O Gear Burnisher.

a complete range of machine tools for improving the bearing surfaces of gear teeth as they come from the gear cutting machines. In addition to this company's Model OO, which provided an air-equipped machine tool for burnishing gears while mounted with their

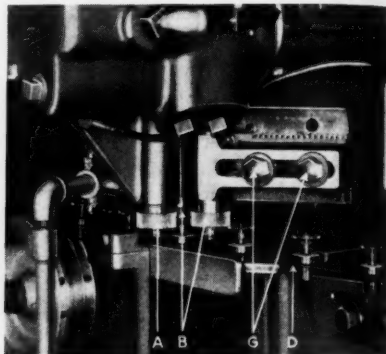


Fig. 2—Close-up view of the Burnishing Rolls With Gear in Position.

for gears from $1\frac{1}{2}$ in. to 14 in. dia. by $2\frac{1}{2}$ in. face width. Cluster-type gears can be efficiently handled on this machine. Larger sizes of gears can be handled on both of these machines by slight modifications in design.

A front view of the Model O Gear Burnisher is shown in Fig. 1, Fig. 2 showing a close-up view of the burnishing rolls with a gear in place between them. The belt conveyor used for handling the pieces is also shown. As many of the gears processed in this machine are of small size, the advantages of the mechanical loading device will be apparent. The burnishing mechanism consists of three hardened steel rolls, A and B. Roll A, in front, is located on a fixed center and is rotated by power. The two rolls B, which are at the rear, are mounted on spindles on a slide so that they may be



No. 277 V.R. Revolving Angle Steel Posture Chairs and No. 3-26 Angle Steel Bench Legs

No. 277 V.R. CHAIR

Adjusts 30 to 35 inches in height. Seat: rolled front, form depressed, 5-ply veneer. Backward and forward sliding adjustment. Backrest, 5-ply veneer, adjusts up and down, tilting to any desired angle. Finish, seat and backrest light golden oak or mahogany. Steel parts, standard olive green enamel, or choice of mahogany brown (not grained), mahogany red (plain) or black. Double-stretcher construction, supporting legs. Ball turned feet, gliders or casters. Tubular footrest, if desired.

No. 3-26 BENCH LEG

Extremely rigid, strong and well braced, resisting all side- and end-way strains. Hand-riveted joints prevent legs from becoming loose or weak. Top and girt have holes properly punched for fastening on of planks. Will not rack out of shape. Finish, olive green enamel. Heights, 30 or 35 inches. Top length, 20 inches. Width 3 $\frac{3}{4}$ inches. Many other numbers and styles to choose from. Ask for catalog. Special legs to order.

... THE BACKBONE OF PROFITABLE PRODUCTION!

INDUSTRIAL ENGINEERS, physiologists, welfare workers—all agree that Angle Steel Posture Chairs induce productive, profitable energy.

These chairs not only correct bad posture—they actually prevent it! For, after all, the human spine is the "backbone" of successful operations in your plant. Proper seat-

ing, correct postural alignment, increase your workers' morale, lower labor turnover, eliminate errors and cut costs to the minimum.

Invest in alert, energetic, productive workers—invest in Angle Steel Posture Chairs.

We also make a complete line of angle and sheet steel equipment for factory, shop and office.

MAIL THIS COUPON

ANGLE STEEL STOOL CO., Plainwell, Michigan

Please send: ☐ Posture Chair Bulletin, Price List.
☐ Catalog No. "C-MMS."
☐ Representative.

Name.....

Address.....

City and State.....

withdrawn by pushing down pedal C. The action of withdrawing burnishers B also pulls forward the conveyor belt D on which the gears are carried to the burnishing rolls. With the gear in position, pedal E is depressed, tripping the air valve which applies air pressure behind the piston connected with the slide carrying burnishers B. The load thus placed on the gear rapidly runs it in to a good bearing. Provision is made for regulating the pressure by a valve with which the pressure may be cut down to the desired amount, as indicated on the gauge F. A micrometer stop at the rear of the slide provides for gauging and duplication.

Provision is made for adjusting the position of the slide carrying the burnishers B in order to accommodate different sizes of gears, the slide being clamped by the nuts G.

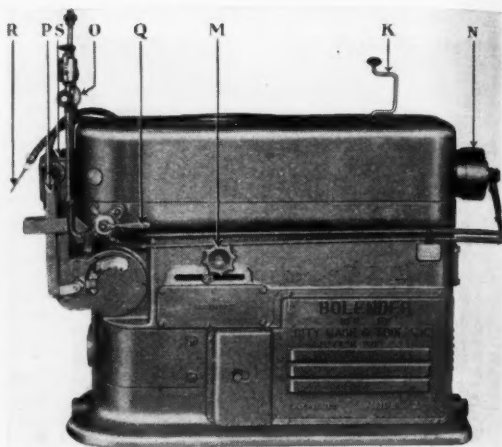
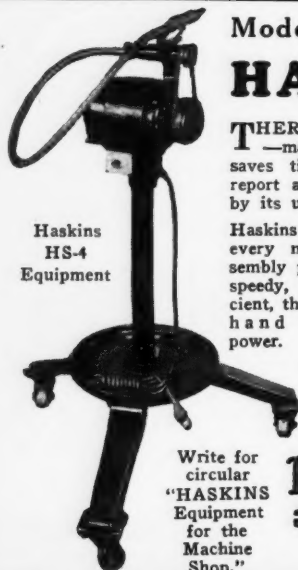


Fig. 3—Bolender No. 2 Gear Burnisher, for Larger Gears.

To provide for burnishing both sides of the gear teeth, a mechanically-operated electrical control is provided which reverses the direction of rotation of the gear while the operation is



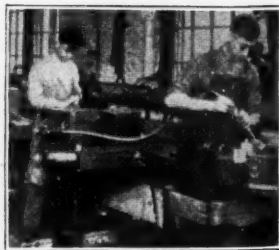
Haskins
HS-4
Equipment

Modern Machine Shops Are Specifying **HASKINS** FLEXIBLE SHAFT EQUIPMENT

THERE'S a reason for this —many, in fact. Haskins saves time and labor—shops report a 10% to 50% saving by its use.

Haskins is adaptable to almost every manufacturing and assembly process. Durable built, speedy, vibrationless and efficient, they answer the need for hand tool flexibility with power.

Let us show you where a Haskins tool fits into your machine shop.



Die Grinding with
Haskins HS-4 Equipment

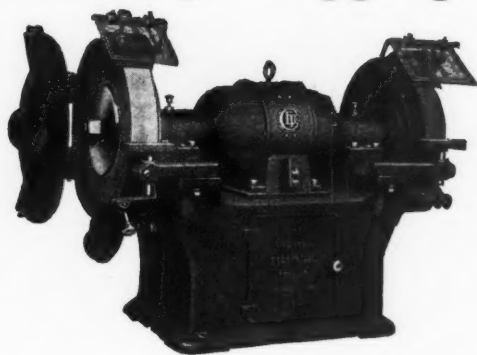
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Shop."

R.G.HASKINS COMPANY

Portable Flexible Shaft Machinery

4653 W. FULTON STREET, CHICAGO, ILL.
Branch Offices in Principal Cities

For that heavy snagging work—



You need a machine that will stand the gaff over a period of years.

The Cincinnati

TRADE MARK

Builders of

The Cincinnati

Ball Bearing Electric
Drills, Screw Drivers,
Nut Setters, Tap-
pers, Valve Grinders,
Aerial Grinders,
Tool Post Grinders,
Floor Buffers,
Bench and Floor
Grinders.



Floor Grinder has all the qualifications for severe, dependable service in the foundry. It is distinctly unusual in durability and rugged in design and equipment.

Study These Outstanding Features:

Timken Roller Bearings—General Electric Motors—Safety Starters with Push Button Control—Adjustable Wheel Guards—Non-breakable Eye Shields—and Chip Breakers.

Furnished at proper speeds for Vitrified or Silicate bond wheels as well as High Speed Wheels (9,000 Surface Feet per minute).

WRITE FOR CATALOG No. 24

The Cincinnati Electrical Tool Co.
CINCINNATI, OHIO

THE CINCINNATI ELECTRICAL TOOL CO.
Cincinnati, Ohio.

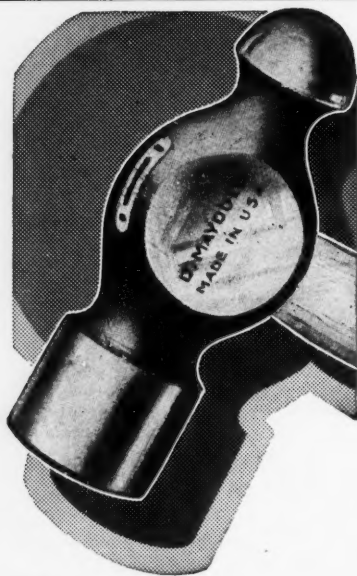
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Name Title

Firm

Address

City and State



You've got a right to expect a lot from a Maydole ---

—and you'll get it because it's built for the man who gives his tools the hardest kind of use.

Tool steel heads, clear, second growth hickory handles air dried for years and put into the heads "for good," a hang that has never been equaled . . . balance, strength and a stubborn resistance to wear are built in.

Your dealer carries them, try one the next time you go in his store.

Please send me a free copy of Pocket Handbook 23 "P."

Mr.

Street

City..... State.....

YOUR HAMMER SINCE 1843
Maydole
Hammers

The David Maydole Hammer Co., Norwich, CT.

in process. The machine is started by throwing switch **H** by hand, which starts the rotation of the burnisher **A**. After a specified number of revolutions, a mechanical tripping device throws a drum-type switch used in conjunction with a magnetic switch which reverses the direction of rotation.

The Model No. 2 machine is shown in Fig. 3, and in Fig. 4 is shown the details of the burnishing rolls with a gear in place. This machine is intended for work that is large enough to be handled readily, consequently an opening is provided in the cover through which the gears are dropped onto a mandrel of suitable form to fit the hole in the gear. Burnisher **I** is driven by power and the two burnishers **J** are loosely mounted on spindles carried by a slide. Adjustment of this slide for

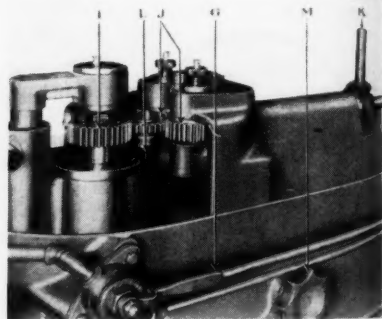


Fig. 4—Burnishing Rolls on No. 2 Machine, With Gear in Place.

center distance is accomplished by means of a crank **K**, which turns a screw on the piston rod, threaded into a nut carried by the slide. Vertical adjustment of the work is controlled by screw **L**, turned by knob **M**. The arrangement of the electric reversing mechanism is the same as on the Model O machine.

Among the exclusive features of these machines is the manner of locating the gears, which lie in a horizontal position with their center lines vertical so that no matter how large or how long the gear, there is no overhang or unevenness in pressure due to uneven weight distribution. Air, which is flexible and can be varied to suit requirements, is utilized for pressure against

Stuart Oils

FOR THE "TOUGHEST"
METAL WORKING CONDITIONS

The RIGHT Oil
For Machining
STAINLESS STEEL

Stuart's

Thred Kut

Alloy Steel Cutting Oil

FOR the THREADING, TAP-
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STAINLESS STEELS, the use of
STUART'S "THRED-KUT" OIL
will disclose new standards of effi-
ciency in respect to the securing of
smoother finish and longer life of
expensive tools.

STUART'S "THRED-KUT" has
become the most highly recom-
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tough work. Order trial drum from
nearest office and warehouse on basis
of 100% satisfaction or 100% credit.

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D.A. STUART & CO.

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CHICAGO U.S.A.
Warehouses in Principal Centers

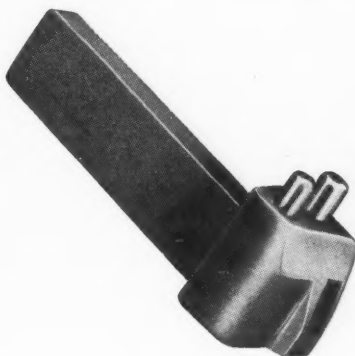
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— A —

TOOL HOLDER

— FOR —

TURRET LATHES



More Economical—
More Pieces Per
Set-Up—
No Side Play—

Sold by Jobbers Everywhere

CIRCULAR UPON REQUEST

WEDGE-LOCK TOOL CO.
2523 N. Keeler Ave. CHICAGO

the burnishers. A continuous, even pressure is, however, assured at all times. An air nozzle for cleaning purposes is indicated at R, and the oil reservoir is shown at S.

B. & S. No. 701 American National Standard Screw Gage

The No. 701 American National Standard Screw Gage, which has been placed on the market by the Brown & Sharpe



B. & S. No. 701 American National Standard Screw Gage.

Mfg. Co., Providence, R. I., makes possible the immediate determination of screw thread sizes according to the American National (and U. S.) Screw Thread Standards. One side of the gage is graduated for the fine thread series

and the other side for the coarse thread series.

One outer edge of one side is graduated to eighths of an inch and may be used as a three-inch scale for measuring the lengths of screws. Slots at either end of the scale permit the heads of both round and flat-head screws to be set against a positive stop for measuring.

Bellevue Electric Soldering Iron Heater

Users of soldering irons in places where gas is objectionable or is not available can now heat the irons in the "Bellevue" electric soldering iron heater, which has been developed by the Bellevue Industrial Furnace Company, 2973 Bellevue Avenue, Detroit, Michigan. This heater can also be used for annealing or hardening small parts. The furnace is $15\frac{1}{2}$ in. wide, $13\frac{3}{4}$ in. high and $13\frac{3}{4}$ in. from front to back. The chamber is 5 in. deep, and the size of the opening is $4\frac{1}{2}$ in. wide by $1\frac{1}{2}$ in. high. The heating elements are the "Globar" Cartridge-Type, which can be

(Continued on page 96)

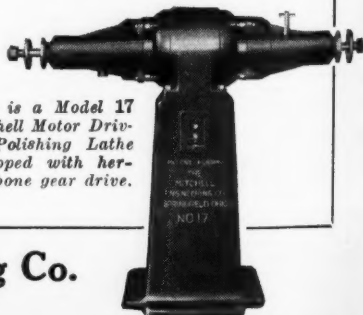
Obtain Any Spindle Speed With the MITCHELL POLISHING LATHE

THE herringbone gear drive of the MITCHELL Motor Driven Polishing Lathe enables you to obtain any spindle speed from 1,800 r.p.m. to 3,000 r.p.m., regardless of the speed of the motor. And you still get all the benefits of a direct motor drive.

Besides, the herringbone gear drive allows the spindles to be placed forward in a straight line with the front of the machine, delivers more than 98% of the motor power to the wheels and is practically noiseless.

Let us show you more advantages of the MITCHELL Motor Driven Polishing Machine with herringbone gear drive. Write for a bulletin!

This is a Model 17 Mitchell Motor Driven Polishing Lathe equipped with herringbone gear drive.



The Mitchell Engineering Co.
SPRINGFIELD, OHIO

CONNECTICUT BROACHES

*for better
RESULTS!*



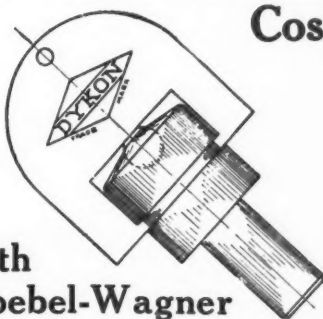
When you use a Connecticut combination round and spline broach you are assured of great savings in time, reductions in tool costs, and a more accurate job. These results are positive because this tool broaches the drilled hole to size, cuts the splines and removes the burrs in one operation.

You cannot afford to overlook these possibilities in your plant. Send us a description of your work and we'll recommend a broach that is guaranteed to give you better results!

**The CONNECTICUT
BROACH & MACHINE CO.**

NEW LONDON, CONN.

Cut Your Grinding Costs



with
**Koebel-Wagner
DIAMONDS!**

ARE your precision grinding wheels doing precision work . . . or, are they dull and unevenly worn? The point is that unless you keep them true and smooth, precision work cannot be obtained at reasonable costs!

Koebel-Wagner Diamonds will true your wheels better — quicker — and with less waste. Each diamond is set in a Safety-Mounting which securely holds the stone in place and prevents loss. These diamonds are protected against abuse by the "Dykon" Gage. This is a small Koebel-Wagner Device which indicates at once when the diamond is worn to its lowest level and requires resetting.

Scores of leading manufacturers throughout the country have found that the use of Koebel-Wagner diamonds lowers their grinding costs and gives better results. These diamonds will lower your costs as well . . . let us show you how . . . send the coupon TODAY!

Koebel-Wagner Diamond Corp.

144 ORANGE ST. NEWARK, N. J.
1200 Oakman Blvd., Detroit, Mich.
310 Citizens Bldg., 850 Euclid Ave.,
Cleveland, Ohio
New York, Indianapolis, Chicago,
San Francisco

Koebel-Wagner Diamond Corp.
144 Orange St., Newark, N. J.

How can I cut my grinding costs
by using K-W Diamonds?

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Firm

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"Produces the Type of Inquiry"

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STEEL EQUIPMENT
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NEW YORK LIFE INSURANCE BUILDING
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CABLE ADDRESS
EQUIPSUP

DISTRIBUTORS FOR
WATSON MANUFACTURING COMPANY
JAMESTOWN, N. Y.

March 25th, 1930

Mr. Don Gardner,
c/o Modern Machine Shop
128 Opera Place
Cincinnati, Ohio

Dear Mr. Gardner:

ALL AGREEMENTS SUBJECT TO DELAYS BEYOND OUR CONTROL. PRICES FOR IMMEDIATE ACCEPTANCE SUBJECT TO CHANGE WITHOUT NOTICE

Due to circumstances entirely beyond our control we are no longer handling the AUTO-SHIFT Drafting Table, and we regret that we shall have to cancel our advertising contract with Modern Machine Shop.

At the present time an advertising salesman from a majority of publications can prove by statistics that practically any product can be sold advantageously through their medium, and the usual failure for results to come up to previous expectations is not surprising.

However, in the case of Modern Machine Shop we have found that your publication not only produces results, but produces the type of inquiry that spells business to any organization. Inquiries from Production Managers, Chief Draftsmen, Vice Presidents, and Engineers have been common since using your publication.

We are indeed sorry that we can no longer use Modern Machine Shop to our advantage, but assure you that if in the future we handle any products that can be sold to factories, machine shops or engineering companies we shall waste no time in renewing our business relations with you.

Very truly yours,

EQUIPMENT & SUPPLY CO., Inc.

By:

Advertising Mgr.

SDL:HB

Says

He ad
men,
using
oppos

A few

If yo
execu
Send
Form
You

Inquiry that Spells Business for Any Organization"

**Says S. D. Lyon, Advertising Manager of
Equipment and Supply Company,
New York City**

He adds, "Inquiries from Production Managers, Chief Draftsmen, Vice Presidents and Engineers have been common since using your publication." Read his letter reproduced on the opposite page.

A few days later Mr. Lyon again wrote us as follows:

"Another feature that may interest you is that our latest advertisement regarding the Jantzen Towel Cabinets has pulled surprisingly well when you consider that we did not expect that such equipment would attract any attention in a publication such as yours, which goes to machine shops and factories."

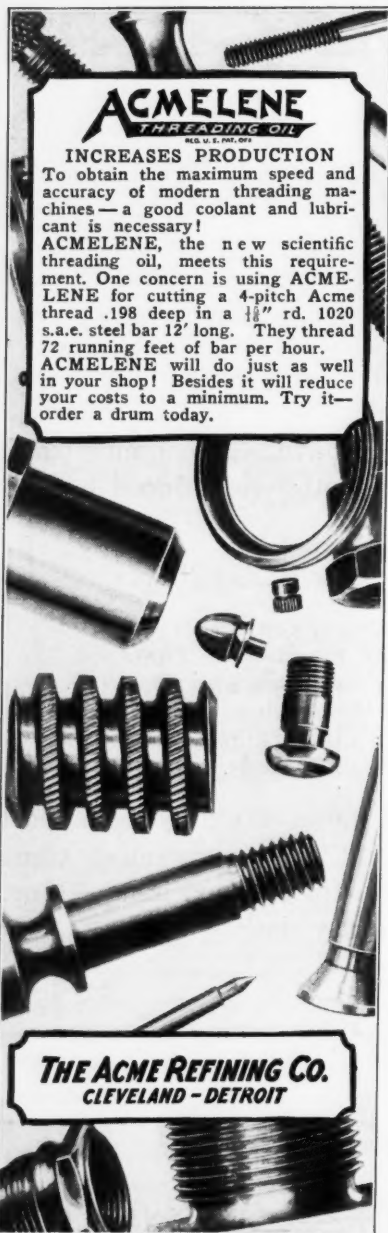
If you have a product in which metal working mechanical executives can be interested, don't waste any more time. Send us your advertising copy *now* for the next issue—June. Forms close Monday, May the twenty-sixth.

You will GET RESULTS!

MODERN
Machine Shop

128 OPERA PLACE

CINCINNATI, OHIO



ACMELENE
THREADING OIL
MADE IN U.S.A.

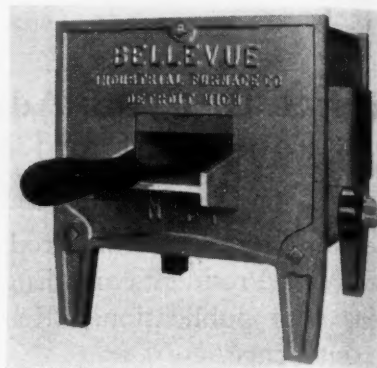
INCREASES PRODUCTION
To obtain the maximum speed and accuracy of modern threading machines—a good coolant and lubricant is necessary! ACMELENE, the new scientific threading oil, meets this requirement. One concern is using ACMELENE for cutting a 4-pitch Acme thread .198 deep in a $\frac{1}{2}$ " rd. 1020 s.a.e. steel bar 12' long. They thread 72 running feet of bar per hour. ACMELENE will do just as well in your shop! Besides it will reduce your costs to a minimum. Try it—order a drum today.

THE ACME REFINING CO.
CLEVELAND - DETROIT

New Shop Equipment

(Continued from page 92)

replaced, when necessary, without dismantling the heater. The replacement cost of these elements is said to be small. No auxiliaries, such as blowers, are necessary for operation. The fur-

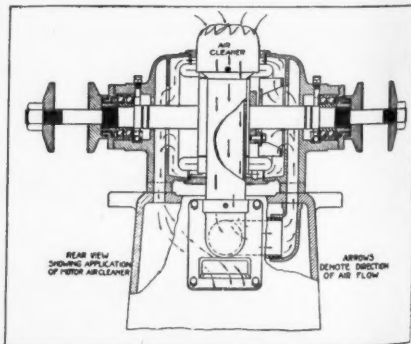


Bellevue Electric Soldering Iron Heater

nace operates on a 110-volt, 15 ampere circuit, drawing 1,600 watts, and can be attached to any 110-volt outlet. Equipment includes an indicating snap switch, 10 feet of flexible heater cord, and attachment plug. The furnace is finished in gray aluminum.

Hammond Motor Air Cleaner

The Hammond Motor Air Cleaner, shown in the illustration, is now standard equipment on all Hammond grins-



Hammond Motor Air Cleaner

Nielsen Live Centers

Stand the "GAFF"!

THE stamina of NIELSEN Live Centers has been proven in a recent demonstration of tungsten carbide cutting tools at the Case School of Applied Science.

A standard No. 6 NIELSEN Live Center was placed on a turret lathe equipped with a tungsten carbide cutting tool. A cut $\frac{3}{8}$ " deep with a feed of .037" per revolution was taken in cast iron at a cutting speed of 500 surface feet per minute.



Next steel with an analysis of .50 carbon, .75 chrome and $1\frac{1}{2}\%$ nickel was turned. A cut $\frac{1}{4}$ " deep with .037 feed per revolution was taken at a cutting speed of 200 feet

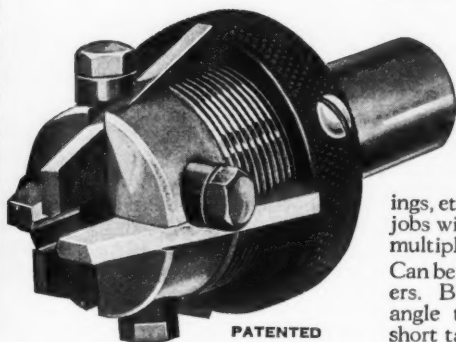
per minute. The center stood up under this cutting load without chatter and showed no sign of breaking down or burning.

There is a NIELSEN Live Center for every center requirement—write for bulletin.

≡ (**NIELSEN, INC.**) ≡
LAWTON, MICHIGAN

Genesee Adjustable Hollow Mill

Made in 7 different styles



Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

A Genesee Adjustable Hollow Mill can be made for every job

WRITE FOR CATALOGUE

GENESEE MANUFACTURING CO., Inc.

ROCHESTER, NEW YORK

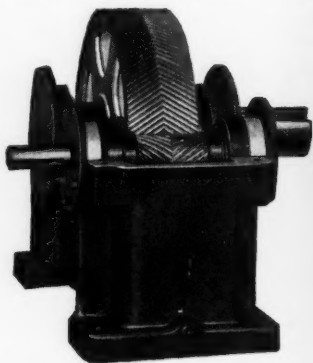
ders and polishers of 3 h. p. and larger sizes. The motor is totally enclosed, but is cooled by a fan on the spindle of the machine. All in-coming air must pass through the centrifugal air cleaner which is directly connected through the pedestal to the cored end bell. The especially designed fan, which is mounted on the spindle, forces the clean, cool air over the motor windings and through the opposite end bell to the pedestal, where it is discharged through the outlet.

This method of cleaning and cooling the air insures an efficient and cool-operating unit, maintaining, as it does, a temperature less than 40 degrees C. The common trouble-makers such as emery dust, metallic dust, chips, and so on, cannot get in to clog the air gap in the motor and damage the motor windings.

Horsburgh & Scott Speed Reducers

The Horsburgh & Scott Co., 5110 Hamilton Avenue, Cleveland, Ohio, is now manufacturing a line of speed reducers

in which the gears are of the herringbone type, as shown in the illustration. The herringbone type of gear is comparatively quiet in operation, strong,



Horsburgh & Scott Herringbone Speed Reducer.

and eliminates end thrust. The pinions are of chrome-manganese steel, forged integral with their shafts, and are ground all over. The teeth are cut on



*Name upon request

This Battery of BRADFORD Unit Type Heads drills, counterbores, and reams one hole 1.123" diameter and two holes 15/32" diameter in less time than any other method!

Another BRADFORD Installation

Proves Its Superiority!

MANY industrial plants increase production with BRADFORD Unit Type Heads, arranged for their special requirements.

And here is a battery of these machines used by a large wheel manufacturer* for drilling, counterboring and reaming three holes in an automobile brake housing. This concern obtains a better job, in less time and at lower costs—proving BRADFORD Superiority!

Investigate BRADFORD Unit Type heads for your work—they will allow you to use standard equipment for special requirements and get better results.

Write for Bulletin!

BRADFORD MACHINE TOOL CO. 659 EVANS STREET CINCINNATI OHIO

EFFICIENCY—DEPENDABILITY

Both Prime Factors Built in

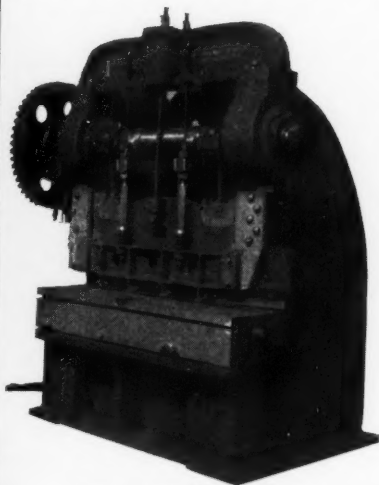
POWER PUNCHING and SHEARING

Machinery Made By

THE LONG & ALLSTATTER CO.
HAMILTON, OHIO

A superior and more complete
line than ever, for perforating
and cutting off metal in practi-
cally any size or shape

**STEEL PRESS BRAKES
ALLIGATOR SHEARS
POWER PRESSES**



Gate Shear, Medium Size

AMERICAN V-2 Broaching Machine

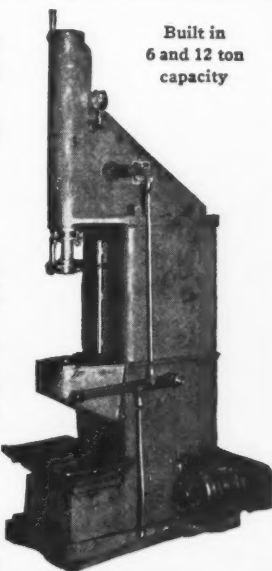
**SMOOTH - POWERFUL
ACCURATE - PRICED RIGHT**

HYDRAULIC PRESSURE is smooth acting, positive,
and powerful—the ideal for accurate broaching. That
is why the American V-2 Broaching Machine is equipped
with hydraulic feed.

It gives the ram a steady, smooth, downward stroke, and
at a speed of 20 feet per minute has enough reserve power,
up to 6 tons, to complete the stroke at this speed. As
soon as the stroke is completed the ram automatically
returns to the starting position.

This feature and many others are completely described in
our bulletin—write for it TODAY!

The American Broach & Machine Co.
ANN ARBOR MICHIGAN



Built in
6 and 12 ton
capacity

FEDERAL DIAL GAUGES For Exacting Work



There are seven reasons for FEDERAL Dial Gauge Supremacy!

They are:

1. The four main bearings are jeweled, just like a fine watch.
2. Racks are chromium plated to insure longer wear and to prevent sticking.
3. Movement is a separate unit which insures perfect alignment of gears.
4. Stem is cast integral with case—it cannot come loose.
5. The die cast case has no soldered joints to come loose.
6. The compound movement permits the use of a 40-tooth rack gear.
7. The entire movement can be removed for cleaning or repairs.

Send for a FEDERAL Catalog. It tells the whole story of FEDERAL Dial Gauges.

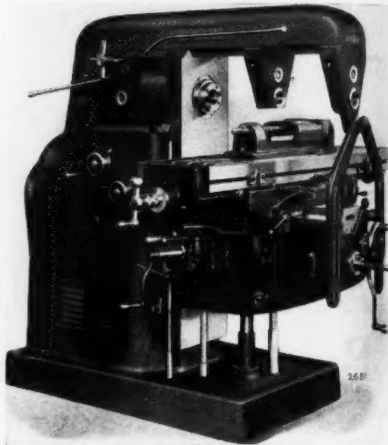
FEDERAL
Products Corp.
PROVIDENCE, RHODE ISLAND

Western Branch:
7338 Woodward Ave., DETROIT, MICH.

the Sykes continuous tooth herringbone gear-cutting machines. The gear blanks are pressed onto ground shafts, trued up, and balanced before the teeth are cut. All shafts are then mounted on Timken bearings. Due to the extreme care taken in the cutting operation, no end play or float is required. The speed reducers will be furnished with any gear ratio desired, to deliver from $\frac{1}{8}$ to 200 h. p., in standard size, leak-proof housings.

Cincinnati No. 4 Plain and Universal Milling Machines

Two new machines—the Cincinnati No. 4 Plain and No. 4 Universal Milling Machines—have been added to the



Cincinnati No. 4 Plain Milling Machine

line of the Cincinnati Milling Machine Co., Cincinnati, Ohio. The No. 4 machines have the same general characteristics as the No. 3 millers announced last September at the Machine Tool Show, but are larger.

The machines have sixteen spindle speeds, ranging from 14 to 450 r.p.m., and sixteen table feeds ranging from $\frac{1}{4}$ -in. to 30 inches, which are changed by an automatic power shift mechanism controlled from either front or rear. The change is effected by shifting the lever located at the front of the knee to the left with starting lever in stopped position until the desired

(Continued on page 104)

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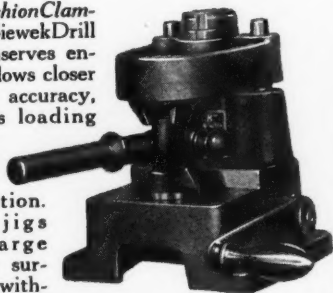
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10232 W

Siewek Drill Jigs

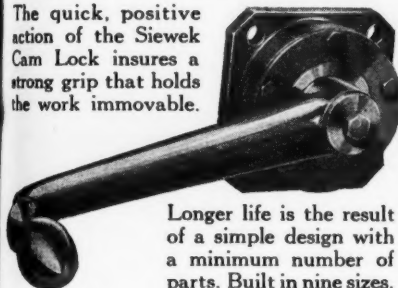
The *Cushion Clamping* of Siewek Drill Jigs conserves energy, allows closer drilling accuracy, reduces loading time, and increases production.

These jigs have large wearing surfaces to withstand hard usage and to maintain their accuracy. It is built in eight types.



Siewek Cam Locks

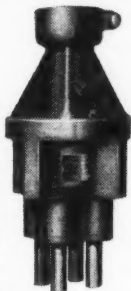
The quick, positive action of the Siewek Cam Lock insures a strong grip that holds the work immovable.



Longer life is the result of a simple design with a minimum number of parts. Built in nine sizes.

Siewek Drill Heads

Siewek Drill Heads, when used in combination with Siewek Drill Jigs, insure a tool set-up that will give maximum production over a long period of time. There is a Siewek Drill Head to meet every requirement.



WRITE FOR CATALOG

Siewek Tool Co.

10232 Woodward Ave., Detroit, Mich.

The PULLMORE Industrial Clutch



is dependable

PULLING heavy loads—year in and year out—with a minimum number of adjustments, is the kind of service you get from the PULLMORE Industrial Clutch, accounting for its use on prominent equipment as follows:

Leading manufacturers of Lathes, Laundry Machinery, Drilling and Boring Machines, Snow Plows, Milling Machines, Testing Machines, Fire Fighting Equipment, Grinding Machines, Cranes, Rubber Working Machinery, and many others.

You can solve your transmission problems with the PULLMORE Clutch. Let us show you how. Just send us the details of your requirements.

Be sure you get the **PULLMORE** Catalog—send the coupon **TODAY!**

Rockford Drilling Machine Co.

10 Catherine Street
ROCKFORD ILLINOIS

ROCKFORD DRILLING MACHINE CO.

Rockford, Ill.

Send me a copy of the **PULLMORE** Industrial Clutch Catalog.

Name..... Title.....

Firm

Address

CityState.....

MMS-5

SERVICE
Is Our Motto

QUALITY
Our Creed



GEAR HOBS

and

"BETTER CUTTERS"



by

BARBER-
COLMAN

of

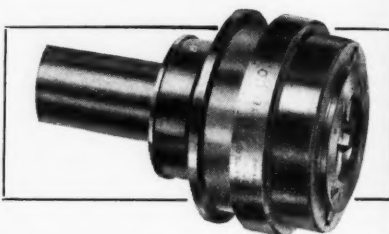
ROCKFORD

THESE Small Tools are built for long hours of steady use... to stand the battering of a heavy feed and emerge triumphant... to hew steadily to the limit line beneath a chattering mountain of chips... Quality to the core... strength and sturdiness ever dependable.

BARBER-COLMAN
COMPANY

General Offices and Plant—Rockford, Ill., U. S. A.

You'll Get
Accurate Threads
with



Murchey Tools

IT'S not an easy job to do accurate threading in large production lots with the ordinary type of threading tool. But MURCHEY tools are not ordinary tools. They are especially designed to enable the fastest equipment to do precision work at top speeds.

Take, for instance, the type C-O self-opening die head illustrated above. This tool is used particularly on automatic screw machines where the die head is revolved. The outstanding feature of the type C-O die head is the collar trip which automatically opens instantly when the desired depth of thread is reached.

Try a MURCHEY Tool on your work—we'll be glad to send one on approval. There is no obligation.

MURCHEY
MACHINE & TOOL CO.

951 PORTER STREET
DETROIT MICHIGAN

Drill Around Corners

WITH A

Koza Right Angle Drill

WHEN it is necessary to put in a hole or drill out a broken bolt in a hard-to-get-at-place—a Koza Right Angle Drill or Grinder will prove itself worth its weight in gold.

Koza Right Angle Drills and Grinders eliminate the necessity of tearing down a machine, to reach the broken bolt or part, by drilling around the corner—at right angles.

These tools may be used for drilling, keywaying or countersinking. There is a tool for every requirement—in every industry.

Write for Bulletin

CHAS. A. KOZA

464 AUGUSTINE STREET
ROCHESTER, N. Y.

"C" CLAMPS



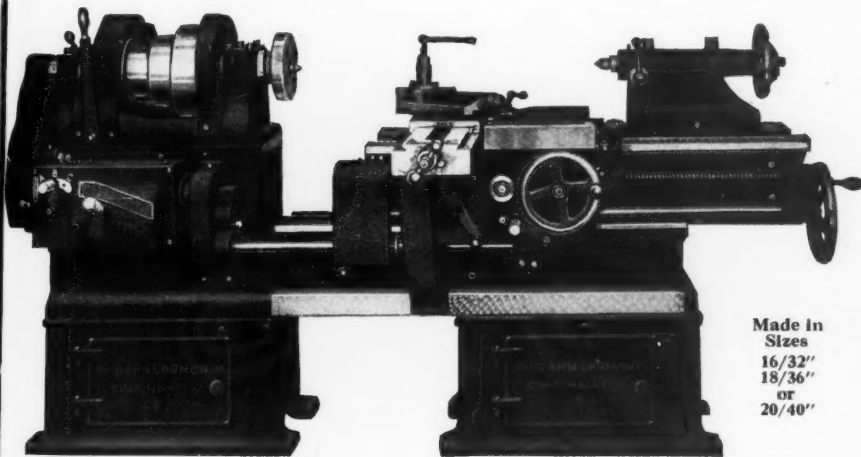
**DROP
FORGED**

Seven sizes, 3
to 12 inches.

13/16" screw.
2 1/2" depth of
throat.

Write for Catalog No.
80, showing Clamps,
Lathe Dogs, and Ex-
panding Mandrels.

W. G. LECOUNT TOOL WORKS
SOUTH NORWALK, CONN.



Made in
Sizes
16/32"
18/36"
or
20/40"

Rahn-Larmon 18/36" Extension Bed Gap Lathe

A lathe for large or small swing work, ready at all times. Requires no extra rigging up. Takes different distances between centers.

Belt driven or with nine speed all geared motor driven head. Tell us what your requirements are and let us quote you.

THE RAHN-LARMON CO.

2935 Spring Grove Ave., Cincinnati, Ohio

New Shop Equipment

(Continued from page 100)

speed, as registered on the upper revolving colored dial, appears opposite the arrow. Engaging the starting lever gives the speed selected. Change of feeds is effected by shifting this same lever to the right until the desired feed, as registered on the lower colored dial, appears opposite the arrow.

Independent directional control levers for cross, vertical, or longitudinal movements of the table are provided. Each movement can be obtained with rapid power traverse with the spindle stopped or running, the rates of speed being: longitudinal, 100 in.; cross, 50 in.; vertical, 50 in.

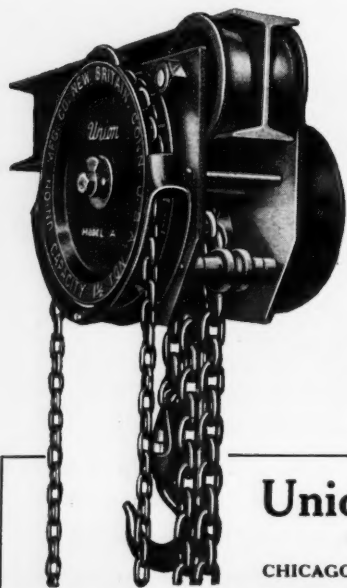
Rear hand adjusting cranks are provided for obtaining accurate cross and vertical adjustments from the rear as well as from the front. The mechanism within the column is automatically lubricated by a geared pump located inside the column. Automatic lubrication by the use of a pump is provided for the knee, while the one-shot system is used for the saddle and table-ways.

Anti-friction bearings are used throughout the spindle drive. The Cincinnati double mounting of anti-fric-

tion bearings both front and rear on the spindle, with a floating rear bearing, are used. Gear contacts in the spindle drive have been reduced, giving 4 on the forward and 5 on the reverse, making a positive drive and reducing the wear on the mechanism. A multiple disc oil clutch is used.

The Cincinnati rectangular overarm has been increased in size and strength. Two aluminum arbor supports, of the self-oiling type, are provided, these supports being 50 per cent lighter, yet stronger, than those of cast iron. In addition, new simplified overarm braces are supplied, also lighter, and designed so that they need not be removed when making a vertical adjustment. There are no universal joints, and the vertical drive shaft is enclosed—a feature which adds to the safety of the operator.

A gutter coolant pump having a capacity of eight gallons is supplied as standard equipment on these machines. The coolant drains from the table into the saddle through a large opening in the rear. The leadscrew construction has been improved, the screw itself being larger in diameter and having a longer bearing in the leadscrew nut. The ends are mounted on a single



UNION HOISTS

Double Service :: Less Repairs

UNION HOISTS make light work of heavy lifting. An easy, steady pull on the hand chain is all that is required to lift a maximum load.

Besides, the Union Hoist is a safe hoist. It is massively proportioned and tested to 150 per cent of its rated capacity. Both Spur Gear and Army Type.

Send for a Catalog describing the complete line of UNION hoists, also UNION chucks.

Union Manufacturing Co.

NEW BRITAIN, CONNECTICUT

CHICAGO NEW YORK SAN FRANCISCO CINCINNATI

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"...and nothing but the Truth, so help me..."

LIKE the good, substantial friend it is, this No. 230 Starrett Mike tells the truth, and nothing but.

The seasoned machinist takes for granted the accuracy of his Starrett Mike. What he tells you about, if you give him a chance, is the assortment of jobs he can do with a Starrett that he can't do with other tools. He'll show you a Starrett Mike, honorable veteran of a thousand arguments, that has helped him do his finest work, year after year, with Starrett Accuracy.

Your men know and respect Starrett Tools. See that they get them. Ask for the new Starrett Catalog No. 25 "MD" illustrating, describing and pricing more than 2500 Starrett Tools, Tapes and Hacksaws.

THE L. S. STARRETT CO.

World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy

ATHOL, MASS., U. S. A.

50th Anniversary of Starrett Tools 1880-1930

Use Starrett Tools

GRIND YOUR TOOLS —on the— GRAND RAPIDS UNIVERSAL TOOL AND CUTTER GRINDER



KEEPING your tools properly ground means that they will cut faster, stay sharp longer and produce better work.

The GRAND RAPIDS UNIVERSAL TOOL and CUTTER GRINDER—built in five sizes—is the ideal machine for this purpose. All types of cutters can be accurately ground on this machine in less time than by any other method.

Dual control for operation from either the front or rear, and a self-contained motor drive which eliminates overhead shafting and belts are just two of the features which make the GRAND RAPIDS UNIVERSAL TOOL and CUTTER GRINDER so desirable in all shops.

Let us show you many more features. Send for Bulletin today!

GALLMEYER & LIVINGSTON CO.

348 Straight Ave., S. W.
GRAND RAPIDS, MICH.

MODEL
AL

The Stork Again!

The GUSHER family is growing! Here is its latest member—a two-stage pump that will develop 39 lbs. pressure, and pump liquids over 90 feet high! It has been designed to supply coolant to a number of machines from a central reservoir.

For further information see our 1930 catalog.

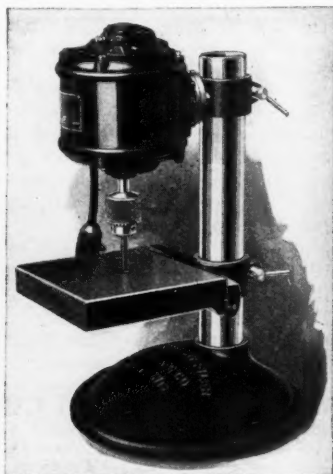
Write For It Today
The Ruthman Machinery Co.
 532 E. FRONT STREET
 CINCINNATI, O.

mounting of roller bearings which takes up both radial and end thrust. It is thoroughly lubricated by the one-shot system, which is provided for lubricating the saddle and table ways. The elevating screw is of the single-piece type, eliminating the sleeve, and the thread bearing of the nut has been increased. The general proportions of the column and knee have been increased and narrow guides and new type gibbing have been added.

The table working surface, both machines, is 75 x 16 in.; the longitudinal range is 42 in.; cross range, 14 in.; and vertical range, 20 in. on the plain machine and 18 in. on the universal. Motor recommended, 10 h. p., 1750 r.p.m. Net weight, belt drive, plain machine, 8400 lb. Universal machine, 8700 lb. Motor drive, plain machine, 8500 lbs. Universal machine, 9000 lb. Floor space required, 116 x 138 inches.

Rausch Rotary Die Filing Machine

The tool shown in the illustration is the Rausch Rotary Die Filing Machine, which has been developed by the Rausch Manufacturing Co., 401 Lake



Rausch Rotary Die Filing Machine

Avenue, Racine, Wisconsin, to eliminate the necessity for hand work in file-finishing irregular-shaped parts. The tool is intended for use on dies, templets, sheet metal model parts, ir-

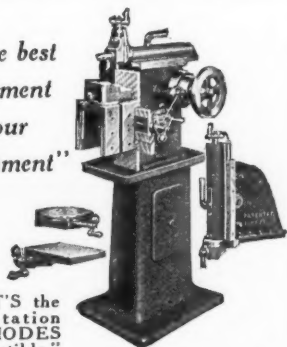
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"---the best
Investment
in our
Equipment"



THAT'S the
reputation
the RHODES
"Convertible"

Horizontal Shaper and Vertical Slotter has
earned in hundreds of plants throughout
industry, because it is a convenient tool for
handling a wide range of work ordinarily
done on larger machines. And it produces
work with a degree of accuracy, speed and
economy that can't be beat. Use a RHODES
"Convertible" in your shop and you, too,
will say, "It's the best investment in our
equipment." Write for bulletin!

THE RHODES MFG. CO.
WALTHAM MASS.



Fight Fatigue

WITH THIS

New Bridgebilt Production Chair

Fatigue is your greatest enemy—it wears
out your workers and slows up production.
But, you can prevent fatigue with this New
BRIDGEBILT Production CHAIR. Try
one in your shop—watch how the operator
retains his energy throughout the day.

We'll send you one on trial. Just mail the
coupon—there's no obligation.

THE CHICAGO WIRE CHAIR CO.
614 N. LaSalle St. Chicago, Ill.

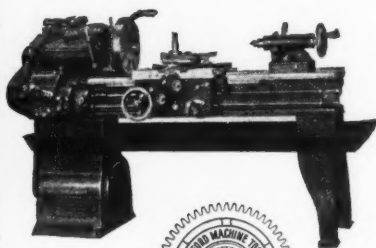
The Chicago Wire Chair Co., Chicago, Ill.

- ☐ Send me a BRIDGEBILT Production
Chair (18" to 30" high.)
- ☐ Send me a BRIDGEBILT Stool
(18"—24" or 24"—30" High).

Name
Address.....
.....

The ROCKFORD "Economy" LATHE

A High Quality Product
at a Popular Price . . .



SATISFACTORY performance of Rock-
ford "Economy" Lathes already installed
—new features in the present design—low
price for a lathe of this high quality and
accuracy. These are three of the factors
which caused the general manager of a tool
and die shop* in New York State to order
six more Rockford "Economy" Lathes.

A repeat order, placed for the reasons given
above, is evidence of the great value in Rock-
ford "Economy" Lathes which deserves seri-
ous consideration. If you are in the market
for a general purpose engine lathe, write to-
day for the latest circular on the improved
Rockford "Economy" Lathes.

*Name furnished on request.

ROCKFORD MACHINE TOOL COMPANY
2414 KISHWAUKEE STREET ROCKFORD, ILLINOIS

regular-shaped gages, cams and formers for profiling, for filing radii on dies, fitting punches to dies, and so on. The tool is especially valuable in fitting punches to dies, as the construction is such that the stock can be removed evenly, a surface can be filed flat at right angles to the base of the die, and the operator can easily work close to a scribed line. By using one of the Rausch Type "B" Rotary Files, the shank will act as a stop and an even amount of clearance can be easily obtained around the punch.

The filer can be used with the motor at the top of the column, as shown in the illustration, or the table can be placed at the top of the column with the motor underneath in an inverted position with the file projecting upward through the table, which gives the operator a clear and unobstructed view of his work. The table can be tilted to obtain the desired amount of clearance-angle. The height of the tool is 18 in.; table area, 9 x 9 in.; distance from column to file, 5½ in.; file capacity, ¾ in.; bench space required, 14 x 14 in., and shipping weight, 105 pounds. Standard equipment includes a ¼ h. p. motor for 110 V., A. C., 60 cycle current.

U. S. Electrical Tool Co. Combination Blower and Vacuum Cleaner

A combination blower and vacuum especially designed for industrial purposes has been developed by the United States Electrical Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. The tool cleans either by suction or blowing, and will pick up dust or other free dirt wherever the tool's nozzle or brush can penetrate. By removing the dust bag—which is a simple operation—and changing the location of the hose, dust can be blown from places hard to get at, such as the inside of motors, machines and switchboards.

One of the outstanding features of the cleaner is the ease with which it can be handled. By hanging the motor and fan over one's shoulder or on a convenient hook, the operator can get into places not possible with the more ancient types of blowers, and can work longer and with less fatigue because of the absence of weight. The cleaner comes in two sizes, complete with hose, nozzle, brush, canvas bag, and shoulder

FACE TO FACE WITH THE FACTS

YOU may not see the Apex line advertised in every journal you pick up, but you are face to face with an Apex ad right now. Read it, and get the point, then do something.

Apex friction chucks stop tap breakage—yes, actually stop it. How, is another story. The main thing with you is the fact that they do it—saving hundreds of firms untold thousands of taps annually—and thousands of dollars in hard cash. They tap true to size—another big point. Cost more? Certainly not.

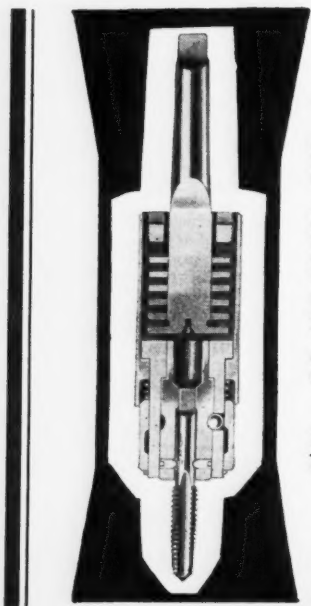
Get a letter off at once. Have us explain, or, better still, get one and see for yourself.

SOME OTHER APEX TOOLS

Also floating tool holder, quick change chucks, universal joint, universal joint nut setters, floating tap sleeves, stud setters, nut setters, etc. New Catalog No. 6 now ready.

APEX

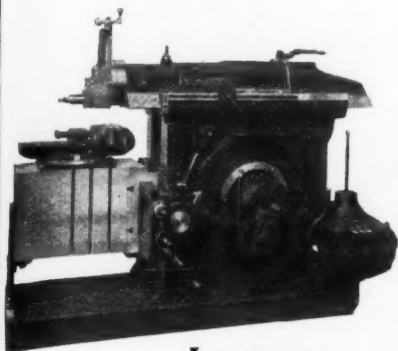
THE APEX MACHINE CO.
302 Davis Avenue Dayton, Ohio



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Increase Your Production With Columbia Shapers

INCREASING production is only a matter of reducing the time element of your different operations.

And you can reduce operating time of your shaping operations through the use of COLUMBIA "Superior" SHAPERS.

One COLUMBIA Feature which saves your time is the patented Quick-Change Feed. This improved feed arrangement permits all feed changes to be made without shifting the position of either the crank or driver. Users save from fifteen minutes to one hour a day with this feature.

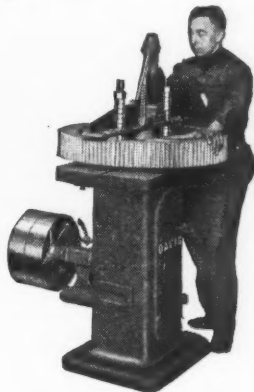
The COLUMBIA Quick-Change Feed is only one time-saving feature. There are many more described in bulletin 17. Get your copy today!

**THE COLUMBIA
MACHINE TOOL COMPANY
HAMILTON OHIO**

2

MINUTES DOES THE TRICK!

The well known "Two-Minute-Set-Up" of the



Davis Keyseater

makes it a money saver in shops where production costs count.

2 Minutes

—and the set up is ready for any job from $\frac{1}{8}$ inch to 1 inch wide, and up to 12 inches high.

2 Minutes

—the operator loses no time on set ups. This allows more time for actual production work.

2 Minutes

is more time than it will take to sign the coupon for full information and bulletin on the Davis Keyseater. Send it today!

Davis Keyseater Co.

250 MILL ST. ROCHESTER, N. Y.

Send me full details on the Davis "Two-Minute-Set-Up" Keyseater.

Name

Firm

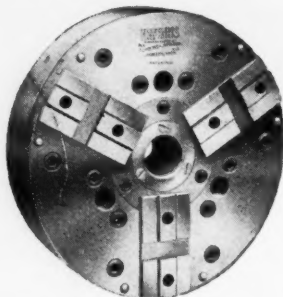
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..... M.M.S.

"HOPKINS"
PREFERRED
EQUIPMENT

**Chucks
Cylinders**
(Pneumatic)

**"A Bear
For Punishment!"**



THREE-JAW CHUCK
(Also available in two-jaw style)

"HOPKINS" CHUCKS stand the gaff of sudden shocks, tremendous strains and continuous, heavy-duty use.

Their bulldog grip, operating stamina, relentless year-in and year-out service, make them universally preferred by manufacturers.

Engineering data and prices sent on request.

"HOPKINS" Non-Rotating, Double Acting Air Cylinders (Series 1, 2, 3 and 4) and Series B and C Air Cylinders, save time, labor and waste motion. Ask us for informative literature and prices.

TOMKINS-JOHNSON CO.

JACKSON, MICHIGAN

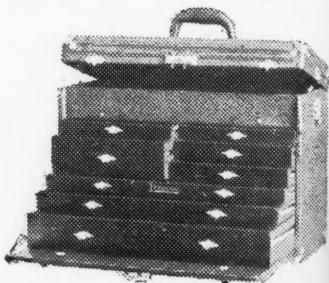
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"U. S." Combination Cleaner and Blower.

strap. The No. 1 size weighs $7\frac{1}{2}$ pounds net, and the No. 2 size, $9\frac{1}{2}$ pounds. Each size is powered by a universal motor which operates on either alternating or direct current. Body is aluminum.

**MACHINISTS AND TOOL-
MAKERS TOOL CHESTS**



**Tool Chests that are right in
construction and price.**

*Send for No. 25 Catalogue of Tool
Chests and Tools.*

WATERSTON'S

420 Woodward Avenue
DETROIT, MICH.

The "CHAMPION" EXPANDING MANDREL

is the only Mandrel which completely and accurately fills the hole.

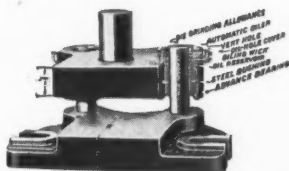
One set of "Champion" Expanding Mandrels—twelve of them—will fill by thousandths any inside diameter from $\frac{1}{2}$ " to $6\frac{1}{2}$ ".

Write for Details!



The WESTERN
TOOL & MFG.
COMPANY
SPRINGFIELD,
OHIO

BAUMBACH *Automatically Oiled* DIE SETS



Standardized die sets, embodying many exclusive features, and a listing of 70,000 stock sizes afford a service that is unsurpassed.

*Your Inquiries Solicited
Send for New 120 Page Catalog*

E. A. Baumbach Mfg. Co.
1806 S. Kilbourne Ave. Chicago, Ill.

USE A POWELL BLOW-GUN

AIR VALVE TO

*blow your turnings
or borings away*

BLO- GUN



*An
interchangeable nozzle
tip for every purpose*

POWELL VALVES

The WILLIAM POWELL Co., Cincinnati, Ohio

Preventing Idleness

(Continued from page 62)

collected on red tags, and plotted curves by departments using a different color for each department. These curves were available at all times to all persons who were concerned in reducing factory burden, and they acted as a guide as to where to concentrate the effort. The main object was to keep the lines on a downward trend and to keep peaks off the chart.

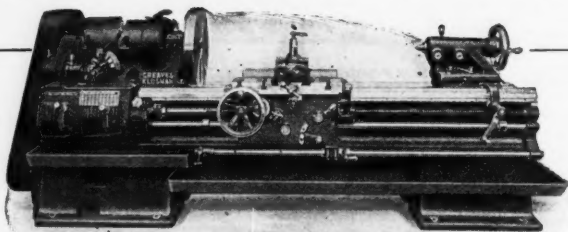
From time to time the idle machine charts were laid out according to months and to machine groups, to give the conditions of each individual group or class groups for a period of six months or more. Then an analysis was drawn off which included all the factors as shown. This shows the production manager where the need for extra equipment exists, where ex-

cessive equipment is located, where the flow of work is uneven, the prevailing cause of idleness on certain machines or machine groups, the need of new equipment to replace old where the machine is constantly going idle for repairs, and a number of little details which were of great assistance to the production manager and his staff.

The production manager, his assistant, the tool and operation department heads, foremen, and even workmen consult the idle machine chart daily for this, that, or the other reason, proving that it is of utmost importance to have an up-to-date method of idleness and burden control that will at all times give the exact conditions as they exist in the shop, whether or not these conditions are improving, and where the source of the trouble is.

G. K. SINGLE LEVER CONTROL SIMPLIFIES LATHE OPERATION

**Built in
Six
Sizes**



**Flexible
Motor
Drive**

Shop Superintendents and production men know that G-K Single Lever Control increases production through its simplified operation.

They know that instead of searching through several combinations of levers, any speed of an extremely wide range can be instantly selected through one lever. They know that an

index plate simplifies the operation still further—it tells at a glance how to obtain the desired speed.

Let us show you many more production increasing features built into G-K Single Lever Control lathes. Send for the G-K Catalog—it gives the whole story.

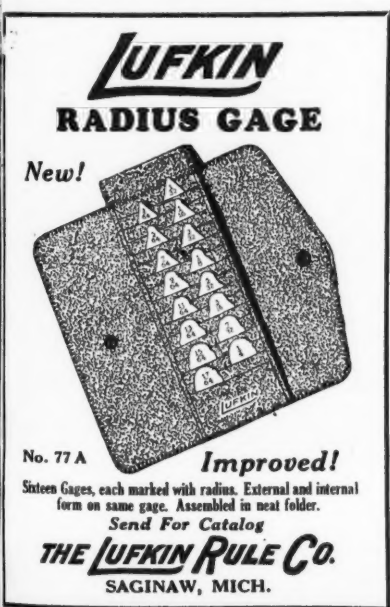
The GREAVES-KLUSMAN TOOL COMPANY
CINCINNATI, OHIO



**HERE'S
A MIKE I CAN
DEPEND
ON**

Swedish Gage Micrometer:
are made by the makers of
the world's most accurate
measuring instruments. They
are sold in America at
civilized prices on a money
back guarantee. Write today
for catalog and prices

PRECISION
MEASURING INSTRUMENTS
SWEDISH GAGE CO. OF AMERICA
7310 WOODWARD AVE., DETROIT, MICH.



LUFKIN
RADIUS GAGE

New!

No. 77 A

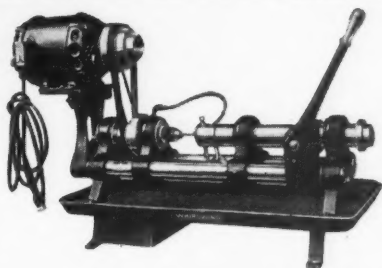
Improved!

Sixteen Gages, each marked with radius. External and internal form on same gage. Assembled in neat folder.

Send For Catalog

THE LUFKIN RULE CO.
SAGINAW, MICH.

Whirlwind HORIZONTAL DRILLING MACHINES



**Increase Production 50 to 100%
Over Vertical Drill Methods**

THE WHIRLWIND will increase drilling production 50 to 100% over that of a vertical drill press. It is adaptable to practically all small drilling and reduces to the minimum the expense of resharpening and replacing drills. This has been proven in many of the country's largest production shops.

**Drill MORE Holes in
LESS Time**

It will surprise you to find how much faster you can do *Production Drilling* with a **WHIRLWIND** Horizontal Drilling Machine. Its horizontal construction permits faster loading of parts to be drilled, while the reverse movement of the feed lever *automatically* ejects the finished work.

Write and tell us what you are drilling and we'll gladly tell you how many pieces per hour we will guarantee the WHIRLWIND to drill.

WHIRLWIND PRODUCTS CO.

1737 Ludlow Ave., Indianapolis, Ind.

TAPPING?



**Balanced Reversing Action
Fool-proof Safety Friction
"Double-Jaw" Tap Holder
All Hardened Gears**

No. 1—7/32-in steel; Safety \$28.00; Positive \$22.00
No. 2—7/16-in steel; Safety 34.00; Positive 28.00
No. 3—5/8-in steel; Safety 40.00; Positive 34.00
No. 4—7/8-in steel; Safety 52.00; Positive 46.00

With the "Proconier" Safety Friction Device blind holes can be tapped just as easily as through holes, and without danger of breakage.

Don't Hesitate To Ask For a Free Trial
Also Safety Tapping Chucks, Tap Holders, Quick-Change Tap and Drill Chucks, Safety Stud and Nut Setters, Bench Tappers and Screw Drivers.

PROCUNIER SAFETY CHUCK CO., 12 So. Clinton St., Chicago, Ill.

OHIO GEARS



The OHIO GEAR Co.
1337 EAST 179 STREET
CLEVELAND, OHIO



Vertical Motor Driven
Grinder Pump,
Ball Bearing Type,
Symbol VD3-S

FULFLO delivers coolant in volumes which promotes efficiency in cutting tools.

The full, copious flow from the Fulflo is needed to make the best tool, with the best coolant, most effective.

FULFLO does not clog, therefore it always works. It's the trouble proof pump.

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Manufactured by
Fulflo Specialties Co.
Blanchester, Ohio, U.S.A.

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Grobet Slotting Files are specially designed and constructed for slotting mica off commutators. They are extremely hard and durable, and fast cutting.

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CABLE SHAPING

1/4 H. P. Type M 5



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SHAFTS
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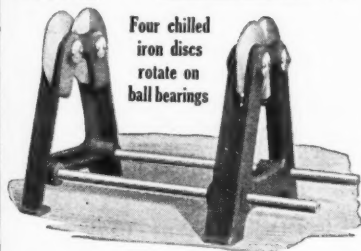
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No Leveling Required

A simple and
excellent device
for balancing,
straightening
and truing.

They are made in
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Swing	Greatest Distance Between Standards	Capacity in Lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	66 in.	5,000
96 in.	88 in.	10,000



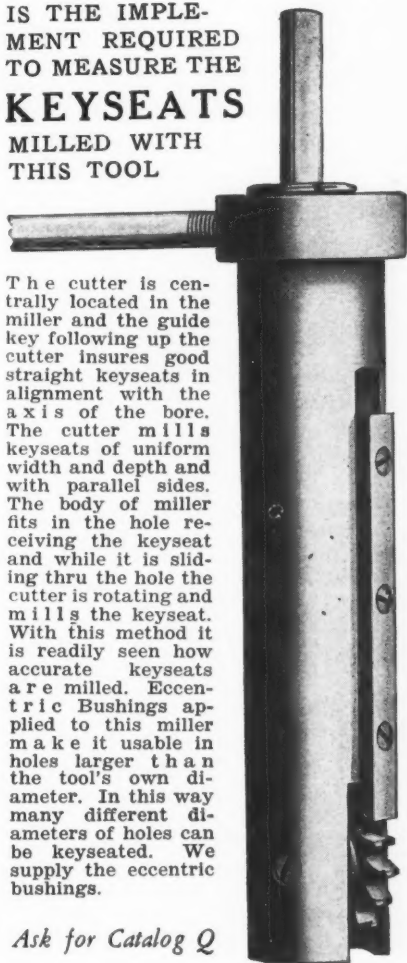
Four chilled
iron discs
rotate on
ball bearings

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By **Anderson Bros. Mfg. Co.**
1926 Kishwaukee Street, Rockford, Ill.

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IS THE IMPLE-
MENT REQUIRED
TO MEASURE THE
KEYSEATS
MILLED WITH
THIS TOOL



The cutter is centrally located in the miller and the guide key following up the cutter insures good straight keyseats in alignment with the axis of the bore. The cutter mills keyseats of uniform width and depth and with parallel sides. The body of miller fits in the hole receiving the keyseat and while it is sliding thru the hole the cutter is rotating and mills the keyseat. With this method it is readily seen how accurate keyseats are milled. Eccentric Bushings applied to this miller make it usable in holes larger than the tool's own diameter. In this way many different diameters of holes can be keyseated. We supply the eccentric bushings.

Ask for Catalog Q

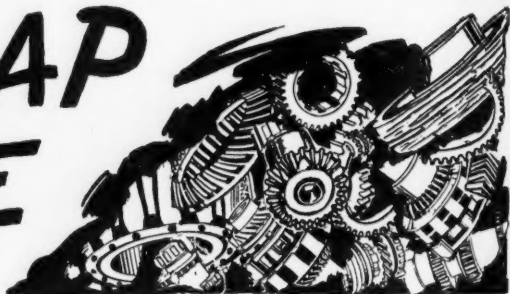
National Machine Tool Co.

2271 Spring Grove Avenue

CINCINNATI, OHIO, U. S. A.

THE SCRAP PILE

By GEO. ALEXANDER MANN



Aw Shuddup

With hair freshly crimped,
It rained—and Miss Link,
With hands o'er her curls,
Said, "God save the kink."

Believe It Or Not

One thing is a cinch—the guy
who writes the beautiful "warm and
welcome" ads for the bank isn't the
one who makes the loans.

Happy Days Are Here Again

They've decided to have short
skirts for the day time and long
skirts for evening. Bless their dear
hearts. An' jes' when the days are
gettin' longer an' the evenings short-
er. Hot dawg.

A Good Investment

To collect five bucks he wuz buzzin'—
To bury a salesman, his cousin;
The P. A. said, "Shucks,
Why ask for five bucks?—
Here's sixty—go bury a dozen."

An' Still Be Consistent

They may do away with war, but
we can always use the war songs for
wedding marches.

"Tis hard to tell what to do when
arrested—hire a lawyer or tell the
truth.

I Ask Yuh

A certain judge says, "There isn't
anything like hard work." Huh—if
there was, would a judge know any-
thing about it?

He lives in peace
With his wife, they say—
He put cement
In her beauty clay.

Wimmin may never have had much
spunk, but it took the thinning o'
the eye-brow fad to prove that they
are there with the pluck.

"We cook with electricity,"
Said waitress Goldie Locks;
He said: "Well, give this steak
A couple more shocks."

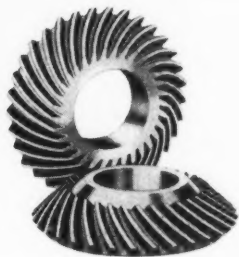
What goes on behind the footlights
ain't in it with what goes on be-
hind the headlights.

Lotsa folks will never know where
the house o' worship is 'til they put
a Tom Thumb golf course on the
church lawn.

Drugged Wuz Right

"The prisoner's been drugged,"
Was the Judge's snort—
"To be sure," said the cop;
"I drugged him to court."

The Best Gear Value For Your Money



Of course, you want the best value for your money—even when buying gears.

And when you specify CINCINNATI GEARS, you are getting *quality*—the best value for your money, because—

There are no better gears made than CINCINNATI GEARS.

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The Cincinnati Gear Co.
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Two-Piece
CORE DRILLS
are ECONOMICAL --

for machining holes 1½" diameter and up in castings and forgings. That is why thousands of these tools are



used every day throughout the manufacturing industry.

Notice the deep fluting for chip clearance and the rugged taper drive. These are two ECLIPSE features which mean increased production and lower costs.

You'll find this tool and many other ECLIPSE high production tools described in the ECLIPSE catalog. Send the coupon today for your copy.

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DETROIT MICH.

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7410 St. Aubin Avenue, Detroit, Mich.

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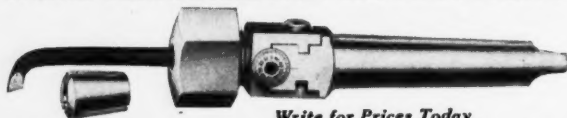
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Palmgren Off-Set Boring Tool WITH MICROMETER ADJUSTMENT



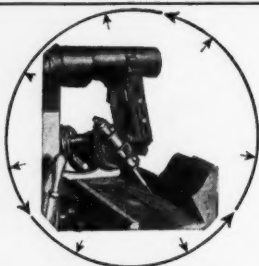
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Made with Morse
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Sharpe, or Straight
Round Shanks.



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Various intricate milling operations can be greatly speeded up with Porter-Cable Milling Attachments. They operate at any angle—in any plane. Easily attached to any round overarm miller in only 3 minutes. Set-ups are reduced, too—for it costs less to move the cutter than the work. Made for hand and power feeds—5 sizes for every need. There's a booklet showing actual savings accomplished. Send for it.

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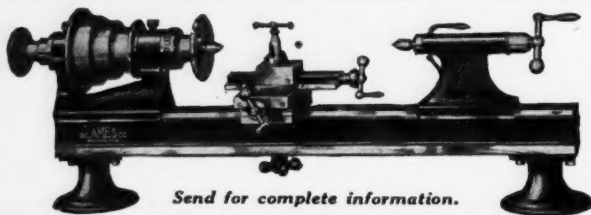
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Seldom idle, this machine will quickly pay for itself sawing, filing and lapping dies, templets, gages, cams, cutters, etc. You should own one.

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For Turning—Drilling
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DETROIT SEMI-AUTOMATIC DRILLING MACHINE

This efficient production machine will drill the work as fast as the operator can load the fixtures. A pull of the lever locks or unlocks the fixtures instantly. Capacity No. 60 to $\frac{3}{8}$ " drills. If you are looking for speed, accuracy, simplicity and low cost operation, try the DETROIT.

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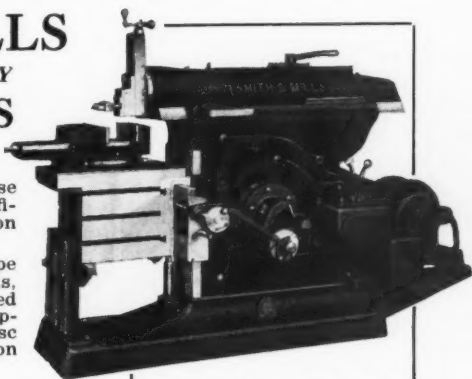
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are the producers. Of simple design, strong and heavy construction, and with high speeds, these machines will be found equally efficient on tool room or production work.

Some of the features are "V" type ram with 55° ways, splined shafts, heat-treated alloy steel gears, speed box shafts mounted on Timken tapered roller bearings, Twin Disc Clutch and one shot lubrication system.

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Acmeleone, The Scientific Threading Oil: The advantages of using Acmeleone, which is an oil that has been developed especially for use in cutting threads, are discussed in a folder that can be obtained without charge from The Acme Refining Co., West 56th St., Cleveland, Ohio.

Hollow-Milling: How production can be increased and costs lowered by the use of adjustable hollow-mills with high speed blades and interchangeable shanks is told in a bulletin that has been issued by Ogden R. Adams, 407 Cutler Bldg., Rochester, N. Y. Copy free upon request.

Aetna Thrust Ball Bearings: Catalog No. 8, published by the Aetna Ball Bearing Mfg. Co., 4610 Schubert Ave., Chicago, Ill., contains complete descriptions and illustrations of the thrust ball retainers made by this firm. Copy free upon request.

High Speed Tapping: The various types of Alto Motor-Driven, High Speed, Self-Contained Tapping Machines are described and illustrated in a series of folders that have been issued by The Alto Manufacturing Co., 1648-52 Wolfram St., Chicago, Ill. Free upon request.

Broaching By Modern Methods: Equipment and tools for finishing round, square or irregular-shaped holes and surfaces by broaching are described and illustrated in a booklet that is issued free by the American Broach & Machine Co., Ann Arbor, Michigan.

Ames Dial Gages: The latest types of dial gages for inspection purposes are described in the Ames No. 55 Bulletin, which will be sent free to any machine shop executive. Address B. C. Ames Co., Waltham, Mass.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for getting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Metal and Wood Saws: Catalog No. 20 describing saws of all kinds, for both metal and wood. 256 pages of descriptions of saws and sawing machinery. E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hob-

bing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Mfg. Co., 1808 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

"C-V" Chrome Vanadium Wrenches: A complete line of wrenches made of Chrome Vanadium steel—practically unbreakable—is described in a booklet that has been issued by the Bonney Forge & Tool Works, Allentown, Pa. Copy free upon request.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

How To Sharpen Staggered Tooth Cutters, Helical Milling Cutters, and Two-Lipped End Mills: A series of pamphlets on these subjects can be obtained without charge by addressing the Brown & Sharpe Mfg. Co., Providence, R. I.

Sheet Metal Problems: The use of the nibbling machine for cutting sheet metal stock is discussed in a booklet which can be had without charge by addressing Andrew C. Campbell, Inc., Bridgeport, Conn.

High Speed Drill Presses: A complete line of drill presses that can be run at high speeds with complete safety is described in catalog number 59, issued by the Cundy-Otto Manufacturing Company, Chicago Heights, Ill. This catalog also contains descriptions of other equipment manufactured by this concern. Sent free upon request.

Boring Tool With Micrometer Adjustment: A circular describing and illustrating the Palmgren Off-Set Boring Tool, which is adaptable for either tool or production work, can be had by addressing the Chicago Tool and Engineering Co., 84th St. and So. Chicago Ave., Chicago, Ill.

Bridgebilt Production Chair: How the Bridgebilt Production Chair will prevent fatigue and increase production is told in a booklet that has been issued by The Chicago Wire Chair Co., 614 N. LaSalle St., Chicago, Ill. Copy free upon request.

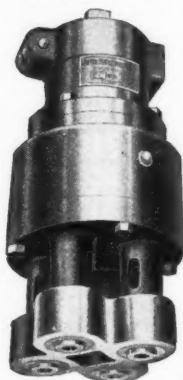
Electric Tools: The complete line of "The Cincinnati" Electric Drills, Grinders, Buffers, etc., manufactured by the Cincinnati Electrical Tool Company, Cincinnati, Ohio, is fully described and illustrated in their new catalog. Free upon request.

Gear Data: The Cincinnati Gear Co., Cincinnati, Ohio, has published Catalog D, which describes and illustrates the various types and kinds of gears made by this firm. The book contains photographs of the plant departments, with descriptions of the equipment employed, and also

OTHER PUBLICATIONS LISTED ON PAGES 122, 124, 126 AND 128.

4

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THE U. S. Drill Head changes your one-hole-at-a-time drilling machine into a multiple drill, by allowing any number of holes—fifty if necessary—to be drilled in the same time as one hole.

The particular head shown drills four holes at one time, but we make drill heads to drill any number of holes to meet your requirements.

Send us blue print of your job, and we will show you what you can save by using a U. S. Drill Head.

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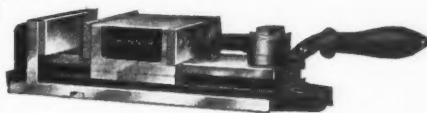
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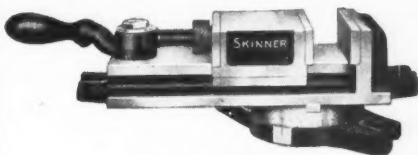
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Plain Vise

HAS A GRIP OF 40 TO 1

THE SKINNER VISE, Dual Action, for Milling and Drilling Machines, combines the range and conveniences of the screw with the quick action of the cam. Rotating the knurled collar on the screw provides the major adjustment, while moving the handle either side towards the center closes the jaws with a powerful grip.



Swivel Vise

Size No.	List Price	Size No.	List Price	Weight Boxed Lbs.	
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NEW BRITAIN, CONN. U. S. A.

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Bolender Gear Burnishers: Gears will operate more smoothly and more silently if burnished. Full description of the Bolender Gear Burnisher can be had by addressing the City Machine & Tool Works, Third and June Sts., Dayton, Ohio.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

Columbia Superior Shapers: Bulletin No. 17, issued by The Columbia Machine Tool Co., Hamilton, Ohio, describes and illustrates the line of heavy duty shapers made by this firm. Copy free upon request.

Columbia Tool Steel Handbook: A book containing valuable information concerning the making of tools, heat treating, uses of hardness testing instruments, uses of the quenching bath, drawing bath, and other heat treating equipment, and together with tables and other useful information can be obtained without charge by addressing the Columbia Tool Steel Co., 550 E. 14th St., Chicago Heights, Ill.

Broaching for Profit: A combination round and spline broach which broaches the drilled hole to size, cuts the splines, and removes the burrs in one operation is described in a circular which will be sent free by The Connecticut Broach & Machine Co., New London, Conn.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Davis Keyseaters: Recent developments in keyseating methods are discussed in a bulletin that also describes the keyseaters made by the Davis Keyseater Company, 250 Mill St., Rochester, N. Y. Copy free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Quantity Drilling: A semi-automatic multiple spindle drilling machine which is designed to produce the maximum of drilled holes in medium or small parts, is described in a pamphlet that is published by the Detroit Machine Tool Co., 5055 Woodward Ave., Detroit, Michigan. Sent free upon request.

Precision Grinding: A booklet which describes and illustrates the most modern methods of performing all kinds of precision grinding operations, showing how the Dumore grinder can be applied to various kinds of machine tools, has been published by The Dumore Company, Racine, Wis. Copy free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and

other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

Gear Tooth Shapes: A study of the fundamental principles of involute gearing and treatise on the development of the standard tooth form are contained in "Gear Tooth Shapes," published by The Fellows Gear Shaper Co., 78 River St., Springfield, Vt. Copy free upon request.

Questions To Ask Before Buying a Jig-Boring Machine: A list of the fine points to look for in a jig-boring machine, with descriptions and illustrations of the working parts of the Swiss Jig Borer, can be obtained free by addressing The R. Y. Ferner Co., 1511 K St., N. W., Washington, D. C.

Silent, Self-Lubricating Gears for use in all kinds of machines are described in a booklet that can be had upon application to Fibroc Insulation Company, Valparaiso, Indiana.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

"Non-Clog" Coolant Pumps are described and illustrated in a booklet which has been issued by the Fulflo Specialties Co., Blanchester, Ohio. Copy free upon request.

Modern Grinding Equipment: The complete line of universal tool and cutter grinders, surface grinders, drill grinders, tap grinders, and other grinding machines made by the Galmeyer & Livingston Co., 336 Straight St., S. W., Grand Rapids, Michigan, is described in a series of bulletins that have been issued by this firm. Free upon request.

Flat Surface Grinding: Automatic, semi-automatic, and single-purpose machines for performing all kinds of grinding operations on flat surfaces are described and illustrated in a book that has been issued by the Gardner Machine Company, Beloit, Wis. Copy free upon application.

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Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Swiss Files: The complete line of Grobet Swiss Files for use in die and tool work or for other fine work is described and illustrated in Catalog "K," published by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Copy free upon request.

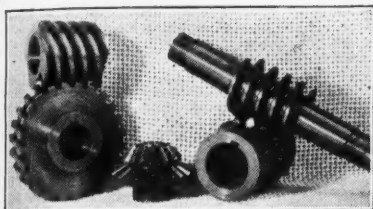
Grinding, Polishing and Buffing Machines of the latest types are described and illustrated in a series of bulletins that have been issued by the Hammond Machinery Builders, Kalamazoo, Mich. Copies free upon request.

Flexible Shaft Equipment Eliminates Hand Labor: Files, drills, grinding wheels, and other tools can be mechanically operated by the use of the flexible shaft equipment manufactured by the R. G. Haskins Co., 4633 W. Fulton St., Chicago, Ill. Catalog free upon request.

Universal Drill Jig: The John's Universal Drill Jig can be used for drilling, centering, milling, reaming, tapping, and other operations with slight changes. Descriptive circular can be had by addressing the Heuser Manufacturing Co., 1633 N. Paulina St., Chicago, Ill.

Drilling and Grinding Electrically: Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders

GEARS



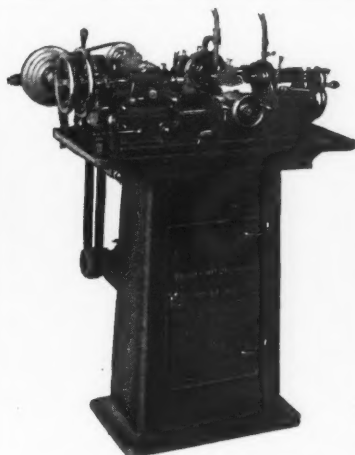
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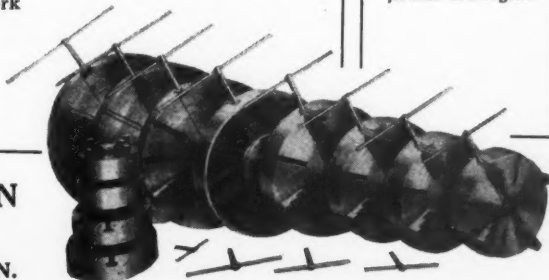
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Speed Reducers: A catalog of speed reducers up to 200 h.p. and built to deliver any ratio desired in standard size units can be obtained by addressing The Horschburg & Scott Co., 5110 Hamilton Ave., Cleveland, Ohio. Give firm name.

"Houghton's Refrigerant Base" and "Hoeht"—metal cutting oils manufactured by E. F. Houghton & Co., Philadelphia, Penna., are fully discussed, together with their outstanding properties, in two booklets which can be obtained without charge by addressing this firm.

"Do It Electrically": The complete line of "Thor" universal electric tools, including tools for drilling, reaming, screw-driving, tapping, nut-setting, grinding, and for performing other operations is described in Catalog No. 17, issued free by the Independent Pneumatic Tool Co., 236 S. Jefferson St., Chicago, Ill.

"Excel" Precision Filing and Sawing Machine: A filing and sawing machine for use in producing templates, dies and other irregular-shaped parts is described and illustrated in a booklet which is issued free by Index Machinery Corporation, 49 Central Ave., Cincinnati, Ohio.

Tool Steel Composition, Selection, and Heat Treatment: William Jessop & Sons, Inc., 121 Varick St., New York, N. Y., has published a series of pamphlets dealing with the above subjects. Copies free upon request.

Special Mil-Waukee-Mills of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

Koebel-Wagner Diamonds for Wheel Dressing: The Koebel-Wagner method of mounting diamonds and the use of the "Dykon" gage are discussed in a bulletin issued by the Koebel-Wagner Corporation, 144 Orange St., Newark, N. J. Free upon request.

Drill Around Corners: Holes can be drilled in close quarters by the use of the Koza Right Angle Drill. Can also be used for keywaying or countersinking. A descriptive pamphlet can be had by addressing Chas. A. Koza, 464 Augustine St., Rochester, N. Y.

Lathe Dogs and C Clamps are described and illustrated in Catalog No. 80, issued by the W. G. LeCount Tool Works, South Norwalk, Conn. Copy free upon request.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Punching and Shearing Operations: A complete line of machines for perforating and cutting metal in practically any size and shape is described and illustrated in a booklet which has been issued by The Long & Allstatter Co., Hamilton, Ohio. Copy free upon request.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Gears: Quick service on gears in either standard or special sizes is available from the Massachusetts Gear & Tool Co., 27 Nashua St., Woburn, Mass. Particulars upon request.

"A Captain of Industry" Pocket Handbook 23-P, issued by The David Maydole Hammer Co., Norwich, N. Y., tells how David Maydole came to make what he considered the best hammer in the world, and also includes descriptions of the various types of Maydole hammers. Several useful tables are included. Copy free upon request.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCroskey equipment is told in a book that is issued by the McCroskey Tool Corporation, Meadville, Penna. Will be sent without charge.

Polish at Any Speed: The Mitchell motor-driven polishing lathe, in which herringbone gears are used to transmit power from the motor shaft to the lathe spindle, can be operated at any desired speed. Bulletin can be obtained by addressing the Mitchell Engineering Co., Springfield, Ohio.

Hi-Production Counterbores: A counterbore of simple yet highly efficient construction, with positive drive, rigidity, and a number of other features is described in a circular which will be sent free upon request. Address Morse Counterbore & Tool Co., 12281 Turner Ave., Detroit, Mich.

Nateo Drilling, Tapping, and Boring Equipment is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Nateo" multiple drilling and tapping machines.

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

"The Answer to Your Gear Problems": Information as to correct methods of cutting and finishing gears will be supplied without charge by The National Tool Co., Cleveland, Ohio. This firm also carries a complete stock of gear shaper cutters and markets the National-Cleveland Spur and Helical Gear Grinding Machine.

Save Time with Expanding Mandrels: How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work, is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 136 Oregon St., Wilkes-Barre, Pa.

Live Centers: The complete line of live centers manufactured by Nielsen, Inc., of Lawton, Mich., are fully described in a bulletin issued by this company. This bulletin is illustrated with photographs and blueprints of the Nielsen Center. Mailed free upon request.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

How To Grind Cemented Tungsten Carbide: A booklet which describes and illustrates the correct methods of grinding tungsten carbide tools has been published by the Norton Company, Worcester, Mass. Copy free upon request.

Correct Cutter and Tool Grindings: Grinder Booklet "E," which is illustrated with 48 photographs, tells how to grind tools correctly and economically. It shows how a solid-backed cutting edge reduces cutter costs and increases production per grind. A copy will be sent free by addressing The Osterlein Machine Company, 3301 Colerain Avenue, Cincinnati, O.

Speed Reducers: Speed Reducers to obtain any desired reduction up to 24,000 to 1 are described and illustrated in Catalog 29-A, issued by The Ohio Gear Co., 1335 East 179th St., Cleveland, O. Copy free upon request.

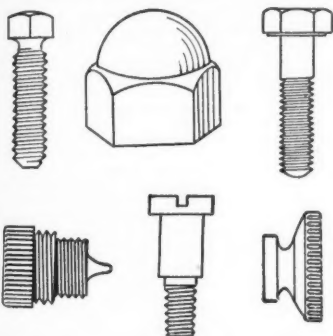
Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Self-Tapping Sheet Metal Screws: Screws which are threaded and hardened in such a manner as to enable them to cut their own threads as they are screwed into

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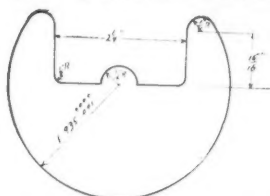
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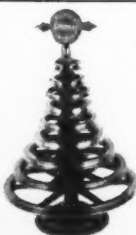
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4	5/8 3/4 1 1/8 1 1/4
5	5/8 3/4 1 1/8 1 1/4 1 1/2
6	5/8 3/4 1 1/8 1 1/4 1 1/2 1 3/4
8	5/8 3/4 1 1/8 1 1/4 1 1/2 1 3/4 1 7/8
10	5/8 3/4 1 1/8 1 1/4 1 1/2 1 3/4 1 7/8 2
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sheet metal assemblies are described in a folder which is published by the Parker-Kalon Corporation, 192-196 Varick St., New York City, N. Y. Sent free upon request.

"Tarring With Tungsten Carbide" is the name of a book that has been issued by The Porter-Cable Machine Co., 300 Wolf St., Syracuse, N. Y. This book answers the most important questions as to the uses of this new cutting alloy, and also describes a new lathe which has been developed especially for use with tungsten carbide tools. Copy free upon application.

Powell "Bio-Gun" Air Valves: Air is faster and more efficient than a brush for cleaning machine tables. The use of the Powell Bio-Gun for this purpose is discussed in a catalog that can be obtained by addressing The Wm. Powell Co., Cincinnati, O.

Tapping Devices, Quick-Change Chucks, Stud-Setting Tools and Bench Tappers: A catalog describing the various types and kinds of tapping, drilling, and stud-setting devices manufactured by the Procon Safety Chuck Company, 12 South Clinton Street, Chicago, Ill., can be obtained without charge by addressing this company. The catalog also tells the part that Procon tools play in obtaining greater accuracy and less tap breakage.

Engines, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahm-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

Shape or Slot With This Machine: The Rhodes Convertible Shaper, made by The Rhodes Mfg. Co., Waltham, Mass., can be used for horizontal shaping or vertical slotting. Details upon request.

Pullmore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

Universal Openside Shaper-Planer: The need of a machine tool to fill the gap between the shaper and the planer has been filled by the development of the Rockford Universal Openside Shaper-Planer, made by the Rockford Machine Tool Co., 2414 Kishwaukee Ave., Rockford, Ill. Full description on request.

Correct Industrial Seating and its relation to fatigue, production, quality work, and problems affecting both workers and employers is discussed in a booklet that can be obtained without charge by addressing Royal Metal Manufacturing Co., 1131 S. Michigan Blvd., Chicago, Ill.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Safety Grinding Wheels: The complete line of grinding wheels made by the Safety Grinding Wheel & Machine Co., Springfield, Ohio, is described in Catalog No. 11, which is issued by this firm. The book also contains instructions for operating grinding wheels, tables of grinding wheel speeds, pulley calculations, and other information for the user of grinding wheels.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-Em-Up" drill sleeve, "Wear-over" chucks, collets, cutters, reamers and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

Equipment for the Shop: Vises for the bench, drill press, milling machine or shaper; angle plates; adjustable clamps, jacks and other tools for the machine shop, are described and illustrated in a booklet that is published by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Ill. Copy free upon request.

Economies in Material Handling: A volume of facts about planned load handling, with actual examples of economies in time, material, and labor costs that have been effected with Shepard electric hoists will be sent free upon request to Shepard Niles Crane & Hoist Corp., 424 Schuyler Ave., Montour Falls, N. Y.

Rapid Drill Jigs: How time can be saved and drilling

operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Slewak Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

"Metal Cutting" is the title of the book that describes the latest methods of cutting metals, and includes descriptions and illustrations of both the band saws and inserted-tooth metal-cutting saws made by the Simonds Saws & Steel Co., Fitchburg, Mass. Copy will be sent free upon application to the firm mentioned.

The Most Efficient Speed for the operation of special production units, power conveyors, and other machinery by the use of the WHS Speed Reducer and how it can be obtained is told in a bulletin that will be mailed free by Winfield H. Smith, Inc., 30 Eaton St., Springfield, N. Y.

Shaping with Modern Equipment: The Smith & Mills Company, 2889-91 Spring Grove Avenue, Cincinnati, Ohio, has issued a booklet which describes and illustrates the line of modern shaping equipment made by this firm. Copy free upon request.

Accurate Gages Speed Production: The complete line of snap, plug, ring, pin, dial indicator, and special gages made by the Standard Gage Co., Inc., Poughkeepsie, N. Y., is described and illustrated in Catalog No. 4, which can be had without charge by addressing this firm. Johansson gage block sets and accessories are also listed in this book.

Machinists' Tools and Gages: Catalog No. 24, issued by the L. S. Starrett Co., Athol, Mass., describes and illustrates the complete assortment of machinists' fine tools and gages made by this firm. Copy free upon request.

Engineering and Manufacturing Service: A complete engineering and manufacturing service for manufacturers who are not equipped to handle all of their own designing, experimental, or production work is described, with illustrations of the equipment available, in a bulletin that is issued by The Steel Products Engineering Co., Springfield, Ohio.

Flexible Shaft Equipment: The uses of the flexible shaft for drilling, grinding, and other operations is discussed in a booklet which also describes and illustrates the flexible shaft equipment made by N. A. Strahl & Co., 5001 N. Lincoln St., Chicago, Ill.

Cutting Oil Data: A series of booklets containing valuable information about cutting oils and their uses for thread-cutting, broaching, and general cutting purposes will be sent free to any mechanical executive by D. A. Stuart & Co., 2727 South Troy St., Chicago, Illinois.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, Finance Building, Pittsburgh, Pa. Free upon request.

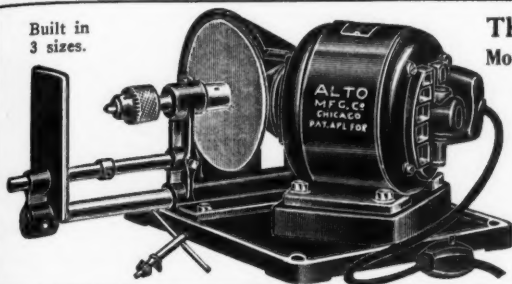
Precision Measuring Instruments: The gages, micrometers, and other precision measuring instruments made by the Swedish Gage Co. of America, 7310 Woodward Ave., Detroit, Mich., are fully described in an interesting booklet that has been published by this firm. Copy free upon request.

Snap, Plug, Ring, and Thread Gages: The complete line of precision gages made by The Taft-Peirce Manufacturing Co., 32 Mechanic Ave., Woonsocket, R. I., is described in a folder which can be obtained, free, by addressing this company.

Save Cutting Oil: How cutting oil can be separated from chips and thus reclaimed by the use of a centrifugal chip "wringer," is told in a bulletin that is issued free by the Tolhurst Machine Works, Troy, N. Y.

Check With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomlinson-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

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is driven with a friction cone. This enables the operator to tap to the bottom of a blind hole without breaking the tap. Speed and accuracy assure you increased production and better results.

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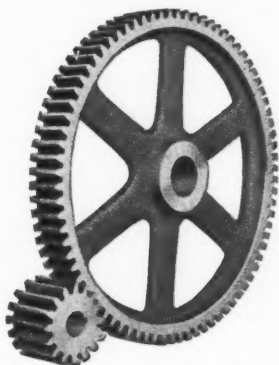


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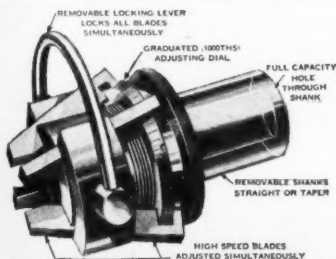
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Powerful, Easy-Acting Chain Hoists of the most modern design are described and illustrated in a booklet that is issued by the Union Manufacturing Co., 296 Church St., New Britain, Conn. Copy free upon request.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

Eliminate Clamping Time: Work can be held without clamps on grinders, planers, and other machines by the use of Walker Magnetic Chucks that are described and illustrated in a series of folders that have been issued by the O. S. Walker Co., Inc., Rockdale St., Worcester, Mass. Copies free upon request.

Accuracy in Thread Production: How accurate threads can be produced by the thread miller is told in a pamphlet that can be obtained free by addressing the Waltham Machine Works, Box 296, Waltham, Mass.

Tool Chests for Machinists and Toolmakers: The complete line of fine tool chests for machinists and toolmakers made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Ask for it.

"Wedge-Lock" Multiple Bit Tool Holder: A new type of tool holder, in which the tool bit is held by the

action of a wedge, is described in a bulletin which will be sent free upon request by the Wedge-Lock Tool Co., 2521 N. Keeler Ave., Chicago, Ill.

Screw Machine Products: Full information as to the manufacturing service on screw machine products maintained by Western Screw Products Co., 19-31 St. George St., St. Louis, Mo., will be sent upon request.

Shop Furniture: A catalog describing and illustrating all kinds of shop furniture, including benches, vices, steel stands, foremen's desks, chip trucks, steel racks for bar stock, steel tote boxes, and other equipment will be sent free upon application to The Western Tool & Manufacturing Co., 1620 East Pleasant Street, Springfield, Ohio.

Wetmore Adjustable Reamers: The exclusive features of the Wetmore Adjustable Shell Reamer are discussed in Catalog No. 29, issued by the Wetmore Reamer Co., 62 27th St., Milwaukee, Wis. Copy free upon request.

Drill Horizontally: The advantages of the "Whirlwind" Horizontal Drilling Machine for high speed drilling on small work are discussed in a bulletin which has been issued by Whirlwind Products Co., 1737 Ludlow St., Indianapolis, Ind. Copy free upon request.

Wrenches For Every Use: "Guaranteed Against Breakage" tapet wrenches, pipe and fitting tongs, offset wrenches, and wrenches for all other uses are described and illustrated in a series of folders which can be obtained without charge by addressing J. H. Williams & Co., Buffalo, N. Y.

"An Inspection Tour of Industrial Plants" is a booklet published by Wilson-Macaulen Co., Inc., Concord Ave. & 143rd St., New York, N. Y., showing the best treating equipment in use in a number of industrial plants, and discussing the manner in which such equipment is automatically controlled. Copy free upon request.

OTHER PUBLICATIONS LISTED ON PAGES 120, 122, 124, AND 126.



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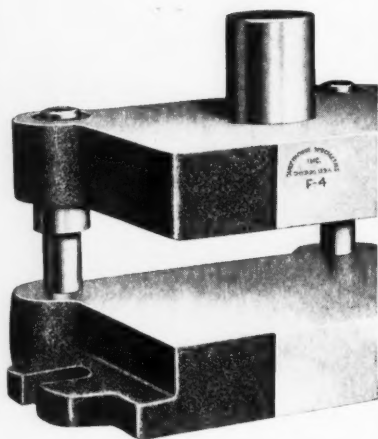


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Standardized, interchangeable punch and die holders;

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Working surfaces ground parallel;

Guide posts and bushings, hardened, ground and lapped, maintain parallelism of punch and die holder "without perceptible shake";

Of semi-steel or steel die holder and semi-steel punch holder.

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Wherever one Hisey TexDrive Buffer goes, more are sure to follow. It has happened in scores of instances. For example . . . the Cadillac Motor Car Company needed new buffing equipment. Investigation of the advantages of the Hisey TexDrive Buffer led to the purchase of one machine. It established such unusual records for low cost production and increased efficiency that fourteen additional TexDrive Buffers were ordered.

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Planed Ways Permit Easy Adjustment of Motor: Motor is moved forward or backward on ways to secure proper belt tension. No idler pulley necessary.

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Flex-Steel Conduit and Fittings: Meet all underwriters' requirements.

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FIBROC GEARS

Wherever sustained accuracy of timing in any machine is required—whether it be timing in automobile ignition or timing printing presses for registration—there you will find gears.

Gears mean fewer parts—less adjustment—longer life.

Fibroc Silent Gears have brought to gear trains a silence that means more than lessened operating noise.

Fibroc Silent Gears mean less vibration—longer life—and a silence that adds a new sales appeal.

Write for full information. All good gear cutters can furnish Fibroc Silent Gears.



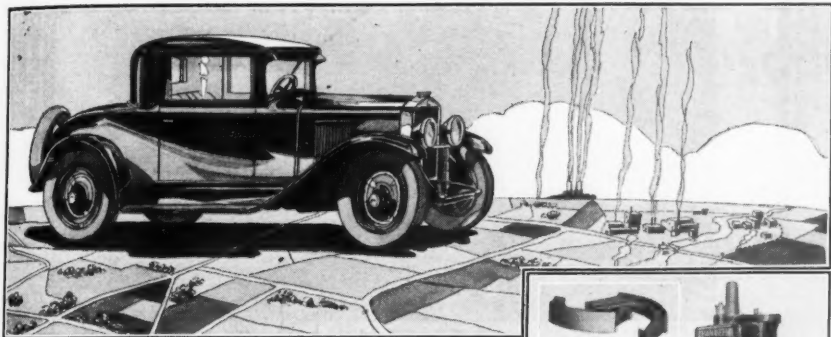
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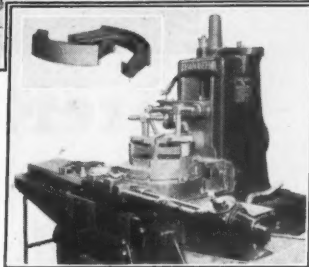
Picture the traveling salesman. He might be selling anything . . . groceries, hardware . . . or machine tools. In former years much of his time was spent waiting for railroad trains . . . lounging in small-town hotels . . . or in idle smoking car conversation. If business was good he had only time enough to skim the cream from his territory . . . was forced to neglect out-of-the-way customers for it would be an endless task to reach them. . . . He was at the mercy of transportation facilities which prevailed fifteen or twenty years ago.

But conditions have changed. The pace in selling has speeded up to match the tempo of modern production. The aggressive salesman now travels alone and travels fast, by automobile instead of waiting on infrequent train schedules . . . and covers his field in half the time and with far greater efficiency.

Sales economy and manufacturing economy go hand in hand . . . but efficiency in production is of first importance. Nowhere can one find such a complete picture of real production efficiency than in the automotive industry. Modern machine tools and mass production methods are making the automobile a great economic factor in present day business. And progressive Milling Methods play no small part in this development.

In the world's leading automobile plants Milwaukee Milling Machines are being used in ever-increasing numbers for their accuracy and dependability have gained wide-spread recognition.

K & T leadership in all industries is the result of 'Milwaukee' efficiency in the hands of the user.



This Mil-Simplex-Mil Simplex released three operators for other work, replaced several other machines in the line with a resultant saving in floor space, and actually increased production over 100%.

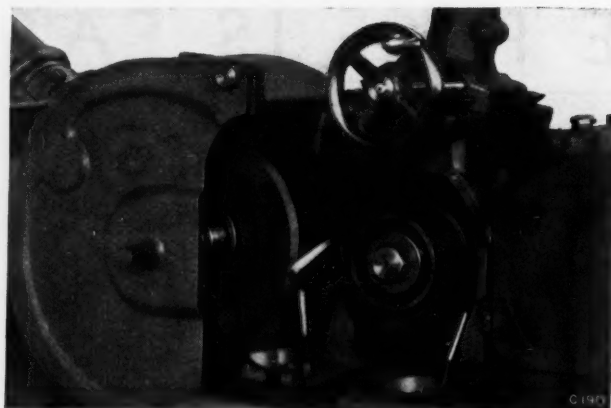
The problem was to circular-mill automobile brake shoes—malleable castings 2 1/2" wide and 11 1/2" around the periphery. A 1403 Simplex with simple hand clamping fixture and skip-stop rotary table assured continuous production.

As proof that Milwaukee Milling Machines successfully meet the production and accuracy requirements of the Automotive Industry it is our privilege to give you the names of some of the users in the passenger car field. Does not the judgment of these leaders inspire confidence?

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Hudson Motor Car Co.
Hupp Motor Car Co.
Lincoln Motor Co.
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Marmion Motor Car Co.
Moon Motor Car Co.
Nash Motors Company
Oakland Motor Car Co.
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IF IT CAN BE MILLED--MILL IT FASTER!



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THE ability of the Cincinnati Centerless Grinder to quickly and accurately grind out-of-balance work further emphasizes the adaptability of the centerless grinding method to a wide variety of work.

Out-of-balance parts, as for example golf club heads, are ground by the in-feed method. Work is held in firm contact with work support blade by the overhead pressure shoe. This overcomes any possibility of the out-of-balance end of the part to affect efficient grinding.

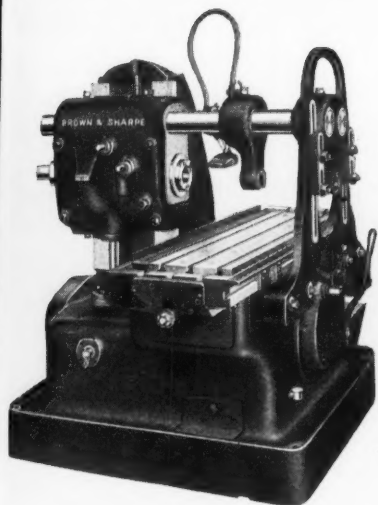
Because of its fast production and ease of operation, Cincinnati Centerless Grinders pay for themselves in a very short time. Large savings are effected by centerless grinding rough or previously machined work. Have you fully investigated the possibilities of adapting this profit-earning precision tool to handle your grinding jobs? All details are illustrated in our centerless grinder booklet. Write for a copy.

This is the seventh of a series of advertisements to tell you the advantages of the Centerless Grinder. Watch for those to follow.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI, OHIO U.S.A.

7
WHAT
CENTERLESS
GRINDING
means
TO YOU





The New

Brown & Sharpe

No. 13B Plain

Milling Machine

IMPROVED PRODUCTION FEATURES—

Base, Table Ways and Column are cast in one piece.

Massive Table with wide bearing surfaces.

All power movements of table can be controlled by Adjustable Dogs. A wide variety of operating cycles obtainable. Directional Hand Control of Table by Single Lever.

Multiple Dry-Disk Clutch provided with automatic compensation for wear.

Anti-Friction Bearings throughout.

Arbor Yokes, Cutters and Arbor can be removed without disturbing the outer brace.

Automatic Lubrication provided for Spindle Head, Speed and Feed Assemblies and Main Driving Mechanism. Single station provided for lubricating table bearings.

The New No. 13B Plain Milling Machine is exceptionally compact and rigid, with powerful cutting qualities and greatly simplified control. Operation of the machine is simple—two levers controlling all functions.

Detailed specifications on this machine will be sent upon your request.

BROWN & SHARPE

BROWN & SHARPE MFG. CO.



PROVIDENCE, R. I., U. S. A.

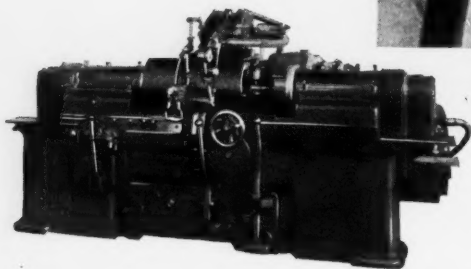
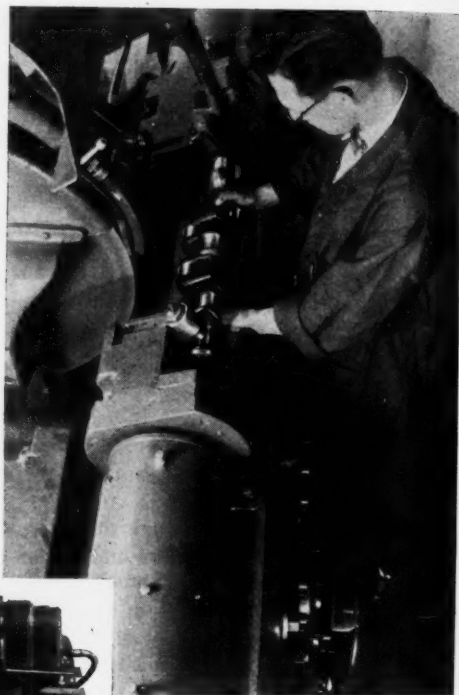
EASY HANDLING OF THE CRANKSHAFTS—

An Outstanding Feature of Crankpin Grinding in the New Norton Model 84, Type B Machine

NOTICE how close to his work the operator can stand. No reaching with heavy shafts extended at arm's length is necessary.

The workholders are low and very near the front of the machine.

Throughout this hydraulically operated Model 84 has been carefully designed to fight fatigue—the enemy of high production towards the end of the day.



NORTON COMPANY
WORCESTER, MASS.

M-255

NORTON
GRINDING MACHINES



NO. 2420 SELF-OILING, ALL-GEARED CYLINDER HONING MACHINE

for
HONING
MEDIUM SIZED
CYLINDERS » » »

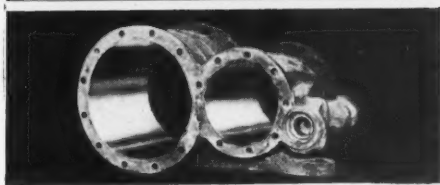
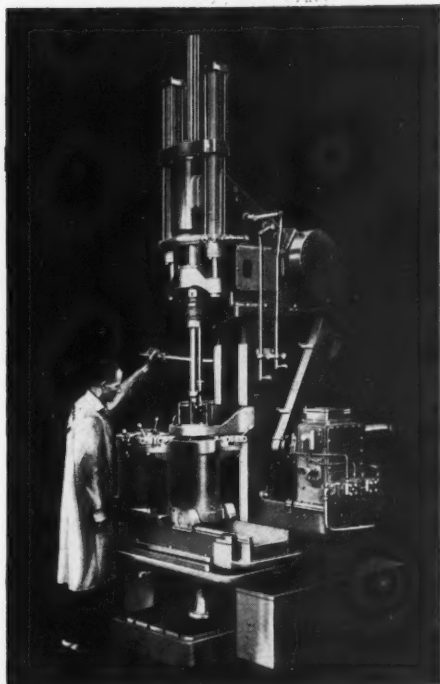
No. 2420 is our latest development for Self-Oiling, All-Geared Vertical Honing of cylinders up to 20" diameter. This size machine is ideal for honing the cylinders used in railroad equipment, several of which are illustrated.

The machine shown is tooled for honing Diesel engine cylinder liners 9" diameter by 23½" long. The duplex fixture, rolling on ball bearings, provides a spare station for loading while honing is in process. Other types of fixtures can be provided for work honed in small quantities.

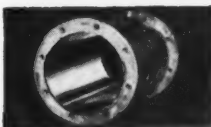
The superior quality, speed and economy of honing small cylinders is well established by the eminently successful operation of Self-Oiling, All-Geared Single Spindle Honer No. 249 and our Multiple Spindle No. 214. No. 3420, recently introduced, hones cylinders up to 54" long, has 56" stroke and swings 36". Now No. 2420 makes the advantages of Self-Oiling, All-Geared Cylinder Honing available for medium sized work. Write today for description and specifications of this machine.

Ask for Bulletin 2420 U

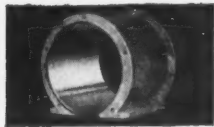
BARNES DRILL CO.
 801-851 CHESTNUT STREET
 ROCKFORD, ILLINOIS, U. S. A.



Locomotive Cross Compound Air Pump Cylinders

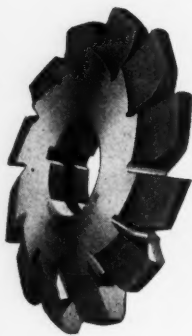


Power Reverse Cylinder for Locomotive



Railroad Air Brake Cylinder

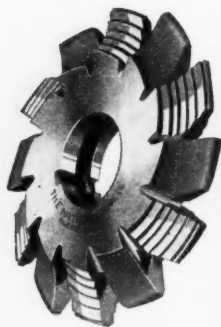
Gear Roughing and Step Stocking Cutters



STYLE A
Roughing Cutter



STYLE B
Step Stocking Cutter

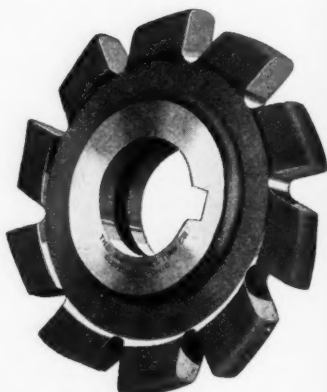


STYLE C
Alternate Plain and Stepped
Stocking Cutter

Illustrated above are a variety of Stocking or Gear Roughing Cutters which we are in a position to furnish.

Like all National-Cleveland Cutting Tools, they are made with but one object in view—Tool Excellency.

National-Cleveland Cutters are available for all general and special purposes—each cutter exactly adapted to its work.



STYLE D
Plain Stocking Cutter

Our Engineering Department will be glad to co-operate with you on your Cutter needs.



NATIONAL-CLEVELAND

CUTTING TOOLS

THE NATIONAL TOOL COMPANY

Madison Avenue at West 112th Street, Cleveland, Ohio

Chicago Offices:

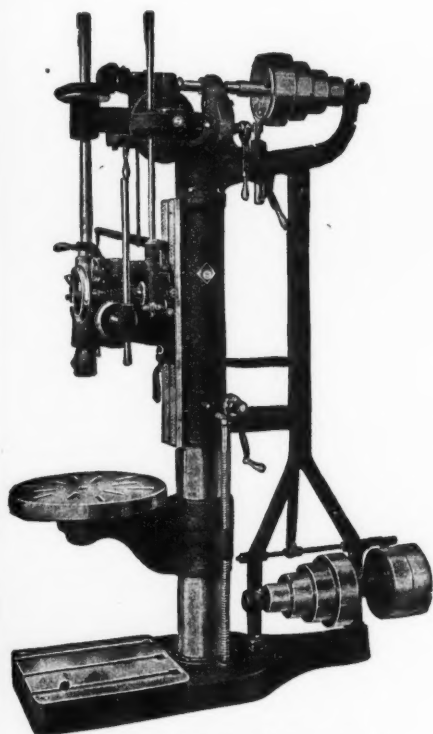
624 Madison Terminal Bldg.

9 South Clinton Street

Detroit Office:

4-155 General Motors

Building



Barnes 26-inch Drill with Power Feed
and Automatic Stop.

Barnes

UPRIGHT

Drills

With Stationary Head —
15, 20, 22½, 25-inch
swing.

With Sliding Head —
22, 26, 28, 34, 42, 50-inch
swing.

Gang Drills—
20 to 26-inch swing.

Barnes Upright Drills are made in a range of sizes from the 50-inch swing, required in the railroad shop, to the 15 and 20-inch sizes used in the small machine repair shop and garage service.

Arranged for Silent Chain or Belted Motor Drive. With or without Power Feed.

Write for Our Circulars Giving Complete Information

W. F. and JOHN BARNES CO.

ROCKFORD, ILLINOIS

Upright Drills

Screw Presses

Horizontal and Vertical Production Drilling and Boring Machines



THIS GEAR Will Help You With Your Job

QUIET, smooth running machinery is a feather in the cap of the maintenance man. It sounds as though he were on the job. Maintenance men have found that Formica gears help them to make good.

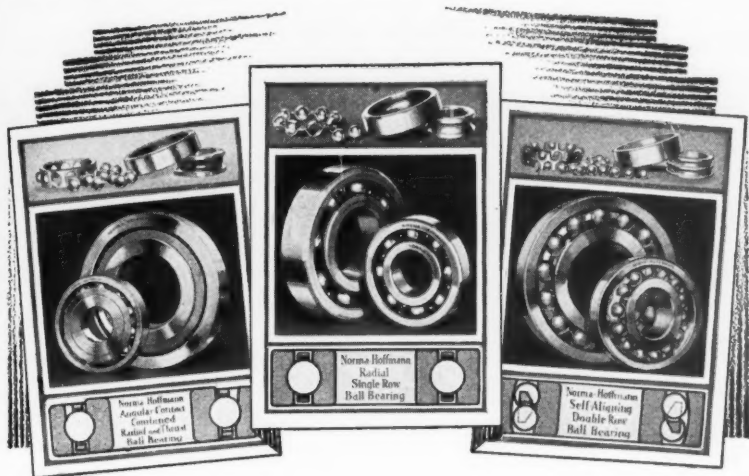
For the same reason more machinery manufacturers use Formica all the time. It makes their machines easier to sell. Their sales departments want it.

Specify Formica the next time you need a replacement gear.

THE FORMICA INSULATION COMPANY
4632 SPRING GROVE AVENUE CINCINNATI, OHIO

FORMICA

BIG BALL BEARINGS ? yes! - up to 18½-inch bore !



The size you need—the type you require—with the PRECISION that means extra value in the way of longer life and higher efficiency.

"NORMA-HOFFMANN" PRECISION BALL BEARINGS

The three standard types, pictured and detailed above, are available to you in a range of sizes to meet your needs. All are marked by that NORMA-HOFFMANN Quality which means extra speed-ability, extra load-ability, extra service-ability. *Better Bearings* for those seeking *Better Service*.

Write for catalogs. Let our engineers help you.

NORMA-HOFFMANN BEARINGS CORPORATION STAMFORD, CONN., U.S.A.
PRECISION BALL, ROLLER AND THRUST BEARINGS

LITTLE LESSONS IN GRINDING COSTS

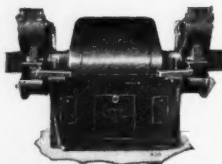
What type of motor is it best to use?

"OF COURSE, we build our grinding machines to take any type of motor specified," Charley Smith explained, "but I personally am strong for the constant-speed squirrel-cage A. C. motor. All things considered, it has proved to be the best bet. It has the most favorable operating characteristics—in maintenance of speed, efficiency, power factor, low first cost and cheap maintenance.

"On the face of it, a *variable-speed* D. C. motor would appear to be ideal. It permits a fine adjustment of speed, so that the spindle speed can be steadily increased as the grinding wheel wears down, thus maintaining grinding efficiency.* Nevertheless, I know of several plants where D. C. motors are not permitted on grinding machines. If you ever had a D. C. motor 'run away,' you will understand why. The speed is increased by interposing a variable amount of resistance in the field circuit. If this field circuit is broken for any reason—by a loose connection, or a short circuit or mechanical damage—the motor speeds up until something breaks. On a grinder that something is nearly always the wheel. And the consequences are generally serious. Furthermore, a special rheostat is required for each individual motor, if *accurate* speeds are to be obtained.

"Constant-speed D. C. motors are subject to the same hazard of field failure, but to a lesser degree because there are not as many connections to maintain and to be responsible for. Field failure relays may be employed, but they

The SAFETY "Rite-Speed" Grinder automatically enforces an increase in speed as the wheels wear down, yet does so mechanically, not electrically. This permits the use of a constant speed A. C. motor... it can't "run away." Ask for Bulletin F-28-3.



"A wheel for every need" ...backed by 37 years' experience.



are delicate devices that add to cost, inspection and maintenance.

"The *multi-speed* type motor for alternating current is another which is fine in theory, but is limited in practical application. The speed steps are too wide for efficient grinding. And the low load factors at high speeds cause very poor power factors.

"So the A. C. constant-speed motor is the type we strongly recommend for our grinders. We use perfectly standard stock motors, hook them up by positive drive to the grinding wheel spindles, and provide fool-proof mechanical means of changing speeds as the wheels wear down.

"It must be that we're on the right track. The SAFETY grinders have been a phenomenal success. Almost without exception they have come out on top in competitive trials. Now, if you will get out one of your Purchase Requisition forms, I'll give you the exact specifications on the particular grinder you need for your work in this plant" . . .

* * * * *

How about it? May we do the same for you? The coupon is for your convenience. It involves no obligation on your part, but may be a source of real profit to you.

* See preceding adv. in this series. We will send you a reprint of it if you wish.

The SAFETY Grinding Wheel & Machine Co.
Springfield, Ohio

SAFETY Grinding Wheel and Machine Co.,

2354 Columbus Ave., Springfield, Ohio.

Please send us file data regarding:

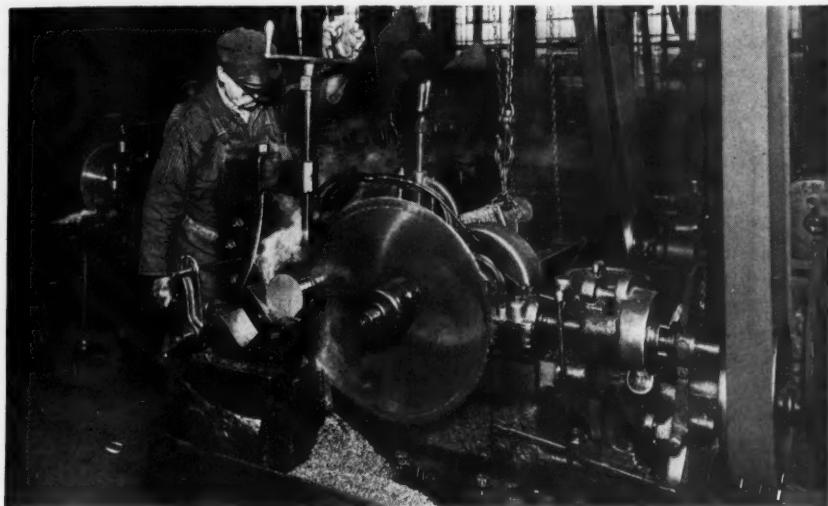
- () "Rite-Speed" Grinders.
- () "De Luxe" Portable Grinders.
- () SAFETY Grinding Wheels.

(Name of Individual)

PIN THIS TO YOUR LETTERHEAD

The Metal Cutter and Grinder

MAY 1930



Another Big Plant Uses Simonds Inserted Tooth Metal Saws

Machine Equipped with Curved Gullet Red Streak Saw Speeds Up Production

In order to demonstrate the wide use of Simonds Red Streak Inserted Tooth Metal Cutting Saws we illustrate above a Simonds saw operating in a nationally known factory in Worcester, Mass. This saw is the new type Red Streak blade with the curved gul-

lets and teeth of special design high speed steel which has been adapted by many of the metal working industries in every section of the United States, Canada and in Great Britain. This particular Red Streak saw is cutting hard metal. Note the smoke curling away as the saw bites through the heavy, tough stock.

If you have metal cutting problems consult our engineers.

Many Mechanics Use Ground Flat Stock

A Superior Simonds Steel
Perfectly Ground and
Ready For Use



Simonds Ground Flat Stock, now being offered the metal industry is a time and money saver. It comes perfectly ground to thickness for adaption to use by die makers and other mechanics in the making of gauges, jigs, templates and various tools. Simonds Ground Flat Stock is made of high-grade carbon tool steel and is uniformly annealed. It is cut to proper length and the most accurate grinding as to width and thickness is done by a new Simonds method.

Ground Flat Stock is furnished in all standard thicknesses. As a time saver it develops into a money saver. Write Simonds Saw and Steel Co., Fitchburg, Mass., if you wish to know how this steel can be most efficiently used in your plant.

Simonds Makes Finest Tool Bits



Simonds Tool Holder Bits being made of special High Speed Steel which is initially harder than regular high speed steel, gives longer service and a finer, smoother cut. In performance they maintain a constant run without variation of standard. Used over a period of time they show a decided saving in production costs. These bits dispense with the necessity of many extra grindings, new set-ups and the labor involved.

To know their quality mechanics should try them.

S I M O N D S

METAL
SAW
MAKERS

WHEN you see brilliant symbols—the "Red Back Edge" or "Red Back Edge" Hack Saw Blade you are assured it is SIMONDS; positive assurance the world's best Hack possible to produce of better steel that longer service.

Ask your supply dealer

**"RED STRIP"
HACK SAW**

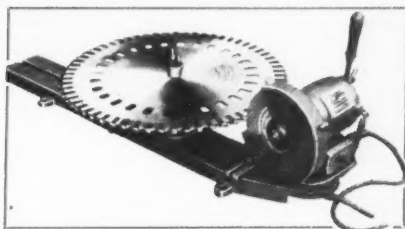
SIMONDS SAW AND STEEL CO.

ESTABLISHED 1882
The Saw Steel
Eight Factories

The Blade with Red Back

The Most Efficient Metal Saw Grinder

Metal Saws
Portable Machine Made By
The Makers of Simonds



Here is another unit of the famous Simonds quality Red Streak products. A metal saw grinder of the most efficient type for which there is now a big demand. It meets the requirements for a portable machine, combining economical operation with most satisfactory performance. It is carefully and strongly built and requires a minimum of upkeep.

A 7-inch diameter Abrasive Wheel one-half inch thick is mounted on the spindle of a quarter horse-power motor which runs at a constant speed of 3400 R. P. M., the ideal cutting speed for these wheels. The motor is adapted to run on a regular lighting circuit of 110 volt capacity, either alternating or direct current. For use on power circuit machines can be furnished with 220 volt motors.

Simonds Mill File For Performance



Users of Simonds Mill Files have found that they cut quickly and easily on lathe work and draw filing. This deep cutting file is well liked by mechanics who have a large amount of filing to do. It is tapered about one-third of the way from point back toward the heel. Although the mill bastard is the most generally used, there are many mill second-cut and mill smooth Simonds files used. If you prefer this file with one or two round edges, your supply dealer can get them for you.

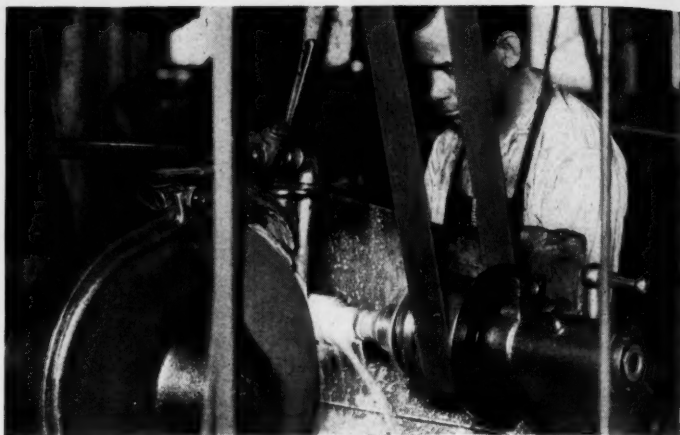
Both kinds for either
Hand or Power Machine Use

Side with the Red End—Tungsten Steel

the Blade with Red Back—High Speed Steel

ABRASIVE

GRINDING
WHEELS



Grinding Master Gauge Plugs...

An operation that requires the highest degree of accuracy, uniformity and close tolerance limits.

In this instance shown above, the tolerance must be kept within .0001" plus or minus and in addition a mirror finish is required.

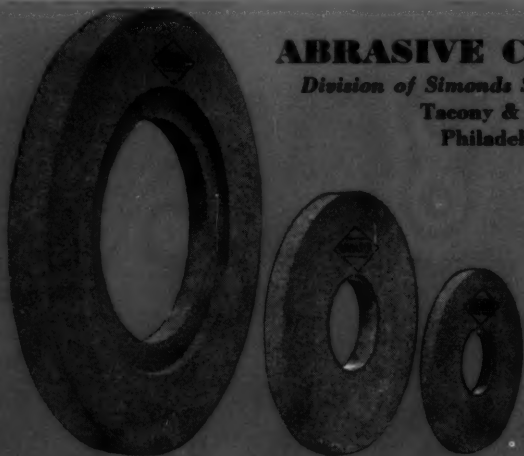
Abrasive grinding wheels have a real duty to fulfill in the plant of this manufacturer and day after day they grind consistently with a fast, cool, free cutting action.

The manufacturers of many types of machine tools have found that Abrasive Wheels prove exceptionally satisfactory for the grinding of the many small parts which go to make up the complete machine.

May we consult with you regarding your grinding problems?

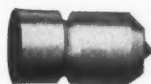
ABRASIVE COMPANY

Division of Simonds Saw and Steel Co.
Tacony & Fraley Streets
Philadelphia, Penna.





Landis Nib



Norton Nib

FOR PRECISION GRINDING ...

... keep your grinding wheels smooth and true with a Desmond Diamond Dresser. The illustrations show a hand tool and diamond nibs for a Landis and Norton Grinder. We also mount diamonds in any special holder that may be required. Send for Catalog M.

THE DESMOND-STEPHAN MFG. CO., Urbana, Ohio

Columbia TOOL STEEL

CLARITE HIGH SPEED STEEL

OILDIE NON-SHRINKING

COLUMBIA SPECIAL CARBON
TOOL STEEL

COLUMBIA EXTRA, ETC.

*It pays to use
Good Tool Steel.*

COLUMBIA TOOL STEEL COMPANY

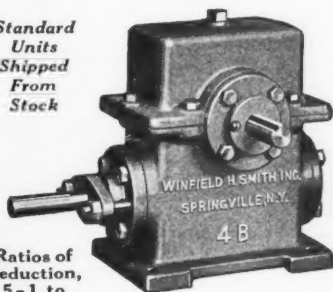
MAIN OFFICE AND WORKS

55 E. 14TH STREET, CHICAGO HEIGHTS, ILLINOIS

CHICAGO	DETROIT	NEW ORLEANS	ST. PAUL
CINCINNATI	KANSAS CITY	NEWARK	SAN FRANCISCO
CLEVELAND	LOS ANGELES	PORTLAND	SEATTLE
DENVER	MILWAUKEE	ST. LOUIS	WORCESTER

W H S Speed Reducers

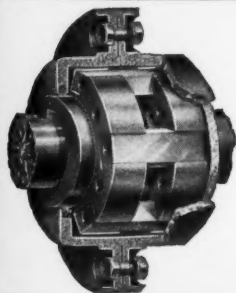
Standard
Units
Shipped
From
Stock



Ratios of
Reduction,
5-1 to
2500-1

Send For Catalog

Winfield H. Smith, Inc.
30 EATON ST.
SPRINGVILLE, ERIE CO., NEW YORK



"Nicholson" Flexible Couplings

All steel, heat treated, lubricated—a flexible coupling built for smooth operation and durable service. No springs or rubber to break and deteriorate. Fully described in Bulletin 329—may we send it?

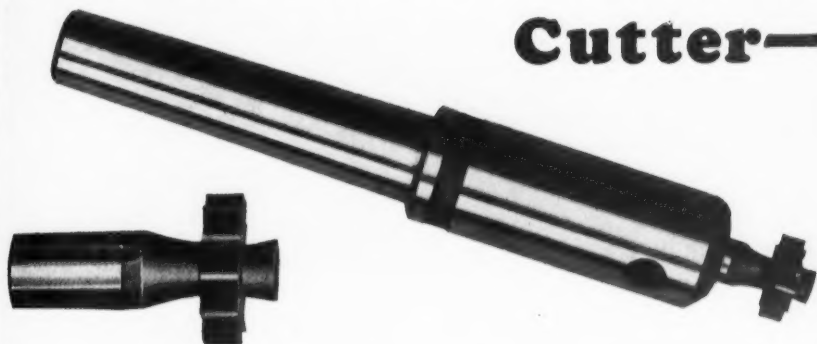
W. H. NICHOLSON & COMPANY
136 Oregon Street WILKES-BARRE, PA.

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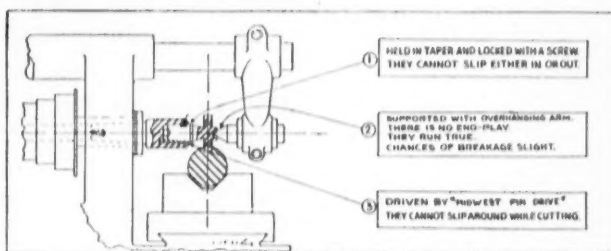
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canno

The Midwest Keyway Cutter—



Gives Better Service

Working at faster speeds, producing more accurate keyways, reducing spoilage, saving money — that's the kind of service you get from the Midwest Keyway Cutter.



THIS CHART SHOWS THE RIGID SET-UP OF THE
MIDWEST KEYWAY CUTTER

The chart shows at a glance the features which make such service possible. Held in the taper shank and locked with a screw, the cutter can slip neither in nor out of the holder. Supported with overhanging arm, there is no end play and the cutter runs true. Driven by "Midwest Pin Drive" the cutter cannot slip around while cutting.

And, all standard sizes are stocked to meet practically all of your requirements. If you have some special requirement, consult our engineering department. They'll solve your problem for you.

*Your copy of our catalog is
ready — where shall
we send it ?*

Midwest Tool & Mfg. Co.

2362 West Jefferson Avenue

Detroit, Michigan

After Many Trials, Experienced

Operators Will Use Nothing

But CLE-FORGE Drills For This Job

TWENTY DRILLS . . . a special multiple spindle press . . . cutting straight and true into metal soon to become the wheel hub for a well known make of motorcycle.

But when these drills must be removed for grinding, a long and laborious set up is involved. And when the size of the pay check depends on the number of hubs drilled, operators want drills that deliver the most holes per grind. That is why they insist on Cle-Forge — will, in fact, accept no other.

Cle-Forge High Speed Drills out-last all others because they are made by a special method which combines the toughness of the forged drill with the accuracy of the milled drill. When tested on



the basis of "cost per hole"—the only sound way to compare drills, the superior economy of Cle-Forge is often as great as 50%.

Let us show you how to cut drilling costs by "cost per hole" comparisons. Use the coupon below to secure Digest No. 72 and complete instructions for making the cost per hole test in your own plant. No obligation. Just mail the coupon.



The **CLEVELAND**
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

SPECIALISTS IN TWIST DRILLS AND REAMERS

TWIST DRILL
COMPANY
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You may send us Digest No. 72 and instructions for making the "cost per hole" test.

Name

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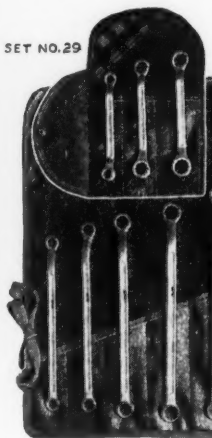
Address

BONNEY

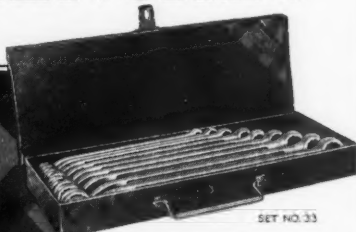
*CV Chrome-Vanadium

DOUBLE END BOX WRENCHES

SET NO. 29



SET NO. 31



SET NO. 33

SOLD IN SETS,
as illustrated

MAY BE PURCHASED INDIVIDUALLY
IF DESIRED

No.	U. S. S. Bolt Size	Hex. Head Cap Screw	S. A. E. Screw and Nut	Open- ings	Length	Thick- ness Head	Price Each
2804		5/16"	5/16"	1-1/8"	5	5/16"	\$1.40
2805	1/4"	5/8"	5/8"	1-1/8"	5 1/2	5/16"	1.50
2806	3/8"	7/8"	7/8"	1-1/8"	6	5/16"	1.70
2814	1/2"	1 1/8"	1 1/8"	1-1/8"	8	5/16"	1.80
2816	5/8"	1 1/4"	1 1/4"	1-1/8"	9	5/16"	1.90
2818	3/4"	1 1/2"	1 1/2"	1-1/8"	10	5/16"	2.00
2822	7/8"	1 3/4"	1 3/4"	1-1/8"	11 1/2	5/16"	2.15
2824	1"	2"	2"	1-1/8"	12 1/4	5/16"	2.35
2826	1 1/8"	2 1/4"	2 1/4"	1-1/8"	13 1/2	5/16"	2.75

(Double End Box Wrenches 12 Point or Double Hex.)

Bonney Double End Box Wrenches are designed with double hexagon openings, making it possible to remove nuts or bolts, even when obstructions will only permit a one-twelfth turn at a "bite." They are wonderfully strong, yet are thin and light in weight.

Set No. 33 contains nine wrenches with openings from 7/16 to 15/16 inches (the Nos. 2814, 2816, 2818, 2820, 2822, 2824, 2826, 2828 and 2830) neatly packed in a metal carrying case. Price.....\$21.25

Set No. 31 contains six of the most popular sizes (the Nos. 2814, 2816, 2818, 2820, 2822 and 2824). Price.....\$12.15

Set No. 29 contains one each of the three short type wrenches, the Nos. 2804, 2805 and 2806, which will take care of the six most commonly used nuts and bolts. Price.....\$5.10

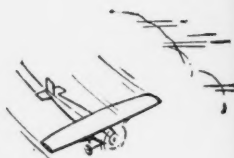
*CV is a Bonney
trademark
registered in
the U. S. Patent
Office

The leading Jobbers carry these wrenches in stock.
BONNEY FORGE & TOOL WORKS
ALLENTOWN, PA.

Makers of Special Service Wrenches of Chrome Vanadium, Carbon Steel Drop Forge Wrenches, Pipe Wrenches, Vises and Drop Forgings and the Bonney Rim Tool.

Chrome
Vanadium
registered
August, 11 1925

Patents Pending



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